MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE. Assistant Editor: H. H. KIMBALL.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for December, 1902, is based on reports from about 3100 stations furnished by employees and voluntary observers, classified as follows: Regular stations of the Weather Bureau, 160; West Indian service stations, 8; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Office, 75; Canadian Meteorological Service, 33; Jamaica Weather Service, 130; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3; Costa Rican Service, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Territorial Meteorologist, Honolulu, H. I.; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José, Costa Rica; Capt. François S. Chaves, Director of the Meteorological Observatory, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; Rev. Josef Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or 10^h 30^m west of Greenwich. The Costa Rican standard of time is that of San José, 0^h 36^m 13^s slower than seventy-fifth meridian time, corresponding to 5^h 36^m west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

December was marked by a succession of severe gales on the British coasts. The most important storm of the month over the western Atlantic advanced from the west coast of the Gulf of Mexico to the middle Atlantic coast of the United States from the 3d to the 5th. Warnings and advisory messages in connection with this storm were telegraphed to Gulf ports on the 3d and to Atlantic coast ports on the 4th, and on the morning of the 5th hurricane warnings were ordered for the southern New England coast. Transatlantic shipping interests were also advised on the morning of the 5th that a severe storm would move northeastward from the middle Atlantic coast of the United States, and cablegrams to this effect were sent to Lloyds, London, the Meteorological Observatory at Horta (Fayal), Azores, and the office of the Halifax and Bermuda Cable Company, Halifax, Nova Scotia. A number of sailing vessels were wrecked along the middle and north Atlantic coasts of the United States during the 5th; off the New England coast the wind attained hurricane force during the evening and night of the 5th. Advices indicate that the northeastern advance of this storm was attended by many marine disasters of a minor character on the coasts of the Canadian Maritime Provinces, and that the subsequent course of the disturbance was south of east, toward the Azores and the southern European coasts. On the Great Lakes the severer windstorms of the month occurred on the 2d, 3d, and 15th, and ample warnings were given of their approach.

Warnings were displayed well in advance of the storms that appeared on the Pacific coast. An interesting feature of Pacific coast weather was a storm that reached the southern California coast on the 16th and traversed the United States during the succeeding six days. It is thought that the cable steamer *Silverton* ran through the north end of this storm when nearly 300 miles southwest of San Francisco.

On the 3d cold wave warnings were ordered for east Texas, Arkansas, and Louisiana, and sugar planters and truck growers in the west Gulf districts were warned of the freezing temperature that occurred in that section on the morning of the 5th. On the 26th and 27th a cold wave swept over the Gulf and South Atlantic States, attended by freezing temperature in the sugar and trucking districts of the middle and west Gulf States and northern Florida, and by frost in central portions of the Florida Peninsula. Ample warnings were given of the freezing weather and frosts of these dates. No very severe cold waves visited the central and northern districts, and interests were cautioned against the moderate cold waves that appeared on the 6th, 7th, 23d, and 24th. The following is an extract from the Galveston, Tex., News, of December 4, 1902, with regard to the cold wave warnings of the 3d:

> Last winter the Weather Bureau saved many thousand dollars to the farmers and truck growers of south Texas by timely warnings of heavy freezes, and yesterday morning when the warnings were telegraphed and telephoned to points of interest no time was lost in getting the tender vegetation under cover. The Weather Bureau's notice was practically two days in advance because the coldest period is expected to-night and early Friday morning. When Sugarland was communicated with the

sugar mills were shut down at once and all hands took to the "tall cane fields," to use a common saying. It was reported that several hundred men were in the field cutting sugar cane and windrowing it an hour after the weather bulletin was received. The army of cutters was being rapidly reinforced and it is expected that several hundred acres of cane will have been cut and stretched on the ground by to-night. A heavy freeze with the cane standing would play havoc and would mean the loss of perhaps thousands of dollars.

The following is an editorial from The Sugar Planters Journal, New Orleans, La., of December 20, 1902:

An evidence of the esteem in which the forecasts issued by the United States Weather Bureau at New Orleans are held, was shown by the sugar planters all over the State by their windrowing thousands of acres of cane on receiving warning of the late cold snap when the temperature fell as low as the freezing point, and in some places even lower.

This faith in the prognostications of the "weather man" was largely brought about by the accurate forecast of the destructive freeze of last December, when the loss to the sugar industry of Louisiana figured, perhaps, upward of several millions of dollars. The exact loss by that terrible freeze will never be known. Had more planters windrowed promptly upon receiving warning last year from the Weather Bureau the loss would have been greatly curtailed. The accuracy of the forecasts as now issued to the sugar planter has had much to do with the growing belief in the efficacy and wisdom of windrowing cane when a cold snap is predicted as about to swoop down on us. Fortunately these warnings are generally issued some twenty-four or thirty-six hours ahead of the freeze, thereby allowing of a considerable amount of cane being placed safe in the windrow before its advent. It is considered by many, though, as wisest not to run too great a risk of being caught with a large area of cane in the field, and we find numbers of planters disposed to windrow about the middle of December, freeze or no freeze, provided they have sufficient cane to put off the end of the campaign to as late as the middle of January.

The Tampa, Fla., Herald, of December 27, 1902, remarked as follows regarding the warnings:

"Heavy and damaging frost to-night" was the brief warning sent out over this section of the State yesterday by the local weather observer, but the warning, despite its brevity, was effective, and doubtless saved thousands of dollars to the planters, especially those who own large pineries, as the cold wave that struck the State was sufficient to grèatly injure the pines.

Mr. W. W. Fisher, President of The United Telephone Company, Bellefontaine, Ohio, under date of December 26, 1902, addressed the following letter to Mr. C. L. Lane, Weather Bureau Displayman at Bellefontaine:

Our telephone company desires to express in writing its appreciation of the cold-wave warning given by you to our superintendent on Wednesday last. We have fifty stations in our system, which extends throughout this and adjoining counties, and this news was immediately telephoned to each station with instructions to circulate the information there. In our system are a great many farmer subscribers, and this news was given to each farmer. We take pleasure in telling you that it was appreciated a great deal more than can be expressed here. We shall be pleased indeed to communicate to our patrons throughout our system any like information that comes to you in your position as voluntary observer of the United States Weather Bureau in our city, and we shall always be glad to render you any assistance, at any time, within our power.

In connection with two storms from the Southwest and a storm that moved eastward over the Lake region, heavy falls of snow occurred in New England, northern parts of the Middle Atlantic States, the lower Lake region, and the upper Ohio and middle Missouri valleys during the first decade of the month. In the second decade of the month a succession of storms that moved eastward and then northeastward from the southern Rocky Mountain and Plateau regions caused heavy snow generally between the Mississippi River and the Rocky Mountains north of Texas, and in southern New England and the interior of New York. After the 20th precipitation was mostly in the form of rain, although considerable snow fell from the Lake region and Ohio Valley over parts of New York and New England in connection with a storm that moved from the upper Lakes to the New England coast during the 24th and 25th, remained nearly stationary off the New England coast during the 26th, and reached Nova Scotia on the 27th. Snow also attended a storm that moved southeastward over the Rocky Mountains to Texas on the 27th and 28th and passed thence rapidly eastward. The heavy snows of the month were, as a rule, successfully forecast.

Flood conditions, due to heavy rains in the Southwest, prevailed in the Red River and tributaries during the early part of the month; by the 25th the river had fallen within its banks at all points. Ample and timely warnings in connection with the Red River flood were issued by the Weather Bureau and given the widest possible distribution in that region.

BOSTON FORECAST DISTRICT.

Ample announcement was made of all severe windstorms that passed over the district. The most pronounced disturbances were those of the 5–6th and 13–14th. During the former hurricane warnings were displayed from Boston to New Haven and were fully justified by winds of hurricance force at and in the vicinity of the display stations. The latter storm was accompanied by snow which, on account of drifting badly, delayed street and railroad traffic. Owing to timely warnings no great damage was caused to shipping by the storms of the month.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

The most important warnings of the month were issued on the 3d for weather to occur on the 5th, when cold-wave warnings were issued for eastern Texas, Arkansas, and Louisiana, and sugar planters and truck growers in Louisiana and Texas were advised that the temperature would fall to 28° in the sugar region by the morning of the 5th. These warnings, disseminated fully forty hours in advance, were practically verified throughout the district. The temperature in the sugar region of Louisiana and Texas ranged from 27° to 30° on the morning of the 5th. Cane was protected by being windrowed generally. Advices state that one planter windrowed 1500 acres; another 1200 acres, and so on throughout the sugar belt, before the lowest temperature occurred.

This is the second season that special warnings specifying the expected temperatures have been issued for the planters of Louisiana, and there have been many expressions of appreciation for such timely and accurate warnings for sugar and trucking interests. (Editorial comment of the Sugar Planters Journal is printed elsewhere.)

The coldest weather of the season, so far, occurred over the northeastern and extreme eastern portions of the district on the morning of the 27th, when the temperature at New Orleans fell to 28°. In the sugar region the temperature was about the same as on the 5th, ranging generally from 27° to 30°. Warnings were issued twenty-four hours in advance of this freeze advising sugar planters that the temperature would fall to 28° in the Louisiana sugar region and to 30° in the Texas sugar region, so that planters who had not finished grinding could prepare for cold weather. In commenting on the cold weather the Times-Democrat of December 28 says:

Throughout the sugar belt there was a temperature that contained few breaths of spring, summer, or fall weather. But the planters had been warned, and if there are those who suffered, it is their own fault. The Weather Bureau had done its duty.

I. M. Cline, Forecast Official.

CHICAGO FORECAST DISTRICT.

The most severe storm of the season crossed the upper Lake region on the night of the 2d and 3d. Storm warnings were ordered up at all stations well in advance. On the 9th warnings were again ordered at all stations, and on the 11th, 12th, and 13th warnings were displayed at nearly all stations on Lakes Michigan and Huron. A severe storm developed in

the Southwest on the 14th and moved northeastward over the upper Lake region, the center reaching the Lakes on the 15th. General warnings were displayed on both these dates.

The regular storm warning season terminated December 16, but advisory messages have been sent since that date to open ports on Lake Michigan in advance of threatening conditions.

The storm warning service rendered by the Weather Bureau during the season just passed has been very acceptable to all Lake marine interests, and practically no disasters through stress of weather overtook vessels that took advantage of the storm warnings and advisory messages. The Lake Marine News Bulletin on December 16 states as follows:

> Captains give the Weather Bureau high praise for the excellence of its storm signals throughout the fall. Except the *Bannockburn*, nearly all the ships lost by foundering or stranding were well along in years, and some of them doubtless not well equipped to meet storms.

No exceptionally severe cold waves crossed over the district during the month, but the most marked condition was that which moved in from the Northwest on the 6th and 7th. Cold-wave warnings were issued for the entire district on the 6th. Warnings were again issued on the 23d and 24th and transportation companies notified.—*H. J. Cox, Professor of Meteorology.*

DENVER FORECAST DISTRICT.

On the morning of the 14th warning of a cold wave was sent to points in western Colorado and northern New Mexico; this warning was fully verified over nearly the entire area. The snowstorm of the 19th in eastern Wyoming and northeastern Colorado, which was forecast, was the feature of the month. The attending high winds were not felt in central Colorado, but in southeastern Wyoming and the extreme northern and northeastern portions of Colorado the high velocities caused the wind to drift the snow badly, and on some railroad lines traffic was suspended three or four days. Fortunately for live stock interests, no very low temperatures attended the storm.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

The month was on the whole rather free from severe storms. Less rain than usual fell, and with the exception of the storm in southern California of the 16–17th the damage was slight. The most interesting feature of the month was the daily receipt of a weather message from the Pacific Ocean, through the courtesy of the Commercial Cable Company, from the cable ship *Silverton*, engaged in laying cable to Honolulu.

Southeast storm warnings were displayed on the 3d from Point Reyes to Eureka, and incoming vessels reported high southeast winds off shore.

Southeast storm warnings were displayed from San Francisco to Eureka on the 8th, and advisory messages were sent to southern ports. In the vicinity of Point Reyes a maximum wind velocity of 54 miles an hour from the south occurred on the 9th.

Heavy rains occurred in central California on the 11th. Heavy frost occurred at many points on the 14th and 15th.

The first report from the cable ship *Silverton*, when about 90 miles off shore, was received on the 15th. An interesting fact is that the steamer then experienced strong southeast wind and rain, and twenty-four hours later, when nearly 300 miles southwest of San Francisco, the wind had changed to strong northwest with confused, heavy sea. The steamer appears to have run through the northern end of the disturbance which reached the coast of southern California on December 16. Unusually heavy rains occurred on the 17th from Point Conception southward. The *Silverton*, then about 500 miles southwest of San Francisco, reported terrific seas all during the night of the 16th, with a heavy swell on the 17th and indications of better weather. The forecasts of rain for southern California for this period were verified. The winds recorded at Los Angeles and San Diego during this period do not indicate any marked disturbance in their vicinity, yet press dispatches would indicate that considerable damage was done near Terminal Island. The Pacific Mail steamer *Barracouta* reports that on the 17th, 20 miles off Point Conception, a severe storm was encountered, hugh waves sweeping clear over the vessel. At both observations on the 17th the wind at San Louis Obispo was reported as light from the west. The last decade of the month was marked by numerous frosts. Ample warnings were given and it is believed that but little injury resulted.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

The month was wetter than usual in the western half of the North Pacific States, while east of the Cascades the precipitation averaged slightly below normal. Several storms of unusual severity passed over the district, for which warnings were ordered well in advance.—*E. A. Beals, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	2, a. m. 2, p. m.	43 53	123 105	4, a. m.	40	97	1,625 1,000	2.0 1.5	812 667	33.8 27.8
II	4, p. m.	27	97	7, a. m.	45	67	2,150	2.5	860	35.8
III	6, p. m.	54	114	10, p. m.	32	65	3,000	4.0	750	31.2
IV	10, a. m.	53	109	13, a. m.	48	68	1,950	3.0	650	27.1
V	12, a. m.	50	100	16, a. m.	46	60	2,400	4.0	600	25.0
VI	13, p. m.	50	120	20, a. m.	32	65	4,300	6.5	662	27.6
VII	20, p. m.	54	114	24, p. m.	48	68	2,800	4.0	700	29.2
VIII	24, p. m.	53	105	29, a. m.	32	65	3,000	4.5	667	27.8
IX	27, p. m.	41	114	31, p. m.	40	75	3,250	4.0	812	33.8
Sums							25,475	36.0	7,180	299.1
Mean of 10 paths							2,548		718	29.9
Mean of 36.0 days									708	29.5
Low areas.										
I	30, p. m*.	48	125	4, a. m.	45	64	3,800	3.5	1,086	45.2
II	3, a. m.	30	95	5, p. m.	46	60	2,225	2.5	890	37.1
III	3, p m.	51	120	5, p. m.	45	93	1,675	2.0	838	34.9
IV	10, p. m.	43	123	14, a. m.	32	65	3,550	3.5	1,014	42.2
V	13, a. m.	33	115	17, p. m.	48	68	3,450	4.5	767	32.0
VI	18, p. m.	35	106	22, a. m.	48	68	2,325	3.5	664	27.7
VII	22, a. m.	52	121	28, a. m.	46	60	3,650	6.0	608	25.3
VIII	26, a. m.	51	120	29, p. m.	48	86	1,625	3.5	464	19.3
IX	27, a. m.	41	105	29, a. m.	32	88	1,500	2.0	750	31.2
Sums							23,800	31.0	7,081	294.9
Mean of 9 paths							2,633		787	32.8
Mean of 31.0 days									768	32.0

*November.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk, Forecast Division.*

RIVERS AND FLOODS.

The Mississippi River at St. Paul, Minn., was closed by ice on the 3d, and at the close of the month it was blocked to within a short distance of Davenport, Iowa.

At the close of the corresponding month of 1901 the river was frozen nearly 200 miles farther south to Hannibal, Mo., and from the 19th to the 26th, inclusive, was practically blocked from Chester, Ill., to Cairo, Ill.

Heavy floating ice at Keokuk, Iowa, on the 8th terminated navigation for the season in that vicinity, while from St. Louis,

Mo., to Cairo, it became so heavy from the 27th to the 31st, inclusive, that it seriously interfered with, but not entirely ended, steamboat traffic.

No ice was observed below New Madrid, Mo., 70 miles below Cairo.

The Missouri River closed at Pierre, S. Dak., on the 4th, and at the end of the month the ice was 15 inches in thickness.

It closed at Omaha, Nebr., on the same date, nine days earlier than in December, 1901. In that portion of the river within the State of Missouri the ice was somewhat later. Navigation at Hermann, Mo., was not suspended until the 26th, whereas in December, 1901, the river at that place was closed on the 19th.

The James River, Dakota, was closed during the entire month, while the Red River of the North, at Moorhead, Minn., was three days later in freezing from bank to bank. At the close of the month there were 18 inches of ice at Moorhead.

Ice was reported in the Ohio River as far as Portsmouth, Ohio, but there was none of consequence in the tributaries, except the Allegheny and those within the State of Ohio.

The rivers of Maine and the Merrimac and upper Connecticut closed for the season from the 5th to the 8th, and the ice at Concord, N. H., on the Merrimac River, was 7 inches in thickness on the last day of the month.

Navigation on the Hudson River was suspended on the 8th, when the last through boat arrived at Albany, N. Y. Timely notice had been given that navigation would have to be suspended on that date. A gorge formed on the 18th at the Bath Pumping Station, just above Albany. Rain caused a breakup on the 21st, but as the ice passed down the river it again became jammed at the freight bridge at Albany, the jam extending to the bottom of the river. Various other gorges formed later in the month, but were devoid of unusual features.

There was plenty of ice in both branches of the Susquehanna River, but very little gorging or solid freezing as far as reported.

Some little ice was also noted in the Shenandoah and upper Potomac rivers.

The flood in the Red River continued during the month. The report on this flood will be published in the Annual Summary for 1902, lack of space preventing its appearance in this edition of the REVIEW.

The unusually heavy precipitation for the month also caused comparatively high water stages in the Ohio River, lower Mississippi, and the rivers of the Middle and South Atlantic States. At Cincinnati a flood tide from the Licking River caused a local rise of 12 feet from the 15th to the 16th, and a fleet of coal boats and barges was swept away, entailing a loss of $25,000. Warning had been given of the coming of this flood wave, for such it was, but the damage could not be prevented.

The Kentucky and Green rivers also discharged a large quantity of water at the same time, but no danger-line stages were reached except at Evansville, Ind., where the river was above the danger line of 35 feet from the 18th to the 26th, inclusive, with a crest stage of 40 feet on the 22d. Due warning was given of the approach of the high water, and no damage of consequence resulted beyond the flooding of some lowlands. In all, the property loss in the vicinity of Evansville was $1500, practically all of which might have been saved had the farmers heeded the warnings. In the vicinity of Mount Vernon, Ind., corn, cattle, and hogs, to the value of $25,000, were saved by the warnings, while at Shawneetown, Ill., the figures were much larger.

Moderately high stages in the South Atlantic States were preceded by the usual warnings, and nothing of unusual interest occurred.

The rivers of the Pacific coast changed but little, with the exception of the Willamette, which rose considerably during the first decade of the month on account of the excessive rains of that period. At Albany, Oreg., the maximum stage was 24.5 feet, 4.5 feet above the danger line, but farther down the river the rise was not so pronounced.

The highest and lowest water, mean stage, and monthly range at 156 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Divison.

The following summaries relating to the general weather and crop conditions during December are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau:

Alabama.—First two weeks favorable for plowing. Very general and heavy to excessive rains during middle of month suspended farm work. Temperature averaged nearly normal until the night of the 25-26th, when a decided fall of temperature swept over the entire State, lasting through the 28th, giving temperatures as low as 8° in northern counties, doing no material damage to wheat and oats, which were doing well. Winter gardens in southern counties not seriously damaged. Some trucking land being prepared.—*F. P. Chaffee.*

Arkansas.—Frequent rains and damp weather retarded picking late maturing cotton, arrested its development, and injured the quality. Too wet for plowing or other farm work. Considerable corn in fields in northeast section; hauling and storing prevented by wet weather. Weather generally favorable for grain; the ground not frozen to any extent until the last week, when there were a few decidedly cold days. Early sown wheat and winter oats in good condition and doing well, but the weather was not favorable for sowing grain. Practically no preparations have been made for next season's crops.—*Edward B. Richards.*

Arizona.—The average temperature during December was slightly below normal, and the precipitation for the month was considerably in excess of the normal. The unusual amount of precipitation for November and December has been beneficial to ranges, and stock is generally doing well, ample feed being promised for the rest of the winter. Considerable grain has been sown and it is doing well. Seeding will continue during the coming month.—*M. E. Blystone.*

California.—The continued cold weather retarded the growth of grain and grass, but caused no material damage. Temperatures below freezing were frequent in nearly all parts of the State, but, as ample warnings were given to orange growers, the severe frosts caused but little injury to the fruit or young trees. Heavy rains in southern California were very beneficial to grain and grass. A large acreage of wheat is being sown.—*Alexander G. McAdie.*

Colorado.—For the mountain region as a whole the snowfall during October, November, and December has been less than normal, but as compared with the corresponding period last year there has been an excess, except on the watersheds of the Grand, White, Yampa, and North Platte. The general outlook for late irrigation, especially on the eastern and southern slopes, was much better than for several years.—*F. H. Brandenburg.*

Florida.—Conditions were most favorable until the middle of the third decade. On the 27th and 28th the weather became very cold, the line of freezing weather touching the northern limit of the southern district. Frost occurred over lowlands of the southern district some distance from the coast. Vegetables suffered throughout northern and central portions, and young citrus trees were slightly damaged. Some oranges in exposed places were frosted.—*A. J. Mitchell.*

Georgia.—The month was slightly colder than the average in north Georgia and warmer than the average in south Georgia. In the middle section nearly normal temperature prevailed. The coldest period was from the 26th to 28th, inclusive, when the minimum thermometer registered below 20° over the larger portion of the State. The general distribution of precipitation was irregular, particularly in the southern counties. The absence of extended cold weather during the month was favorable to fall sown wheat and oats, and no damage from winter killing was reported.—*J. B. Marbury.*

Idaho.—December was nearly normal as to temperature, but the precipitation was excessive. From the 1st to the 12th the precipitation was nearly continuous, but a delightful period of fair weather occurred from the 13th to the 20th, inclusive. The weather during the third decade was unsettled. Heavy snow fell on all the mountains and the winter stock ranges were more heavily covered than usual. Grazing animals suffered and many sheep died owing to scarcity of grass or failure of owners to provide other feed.—*S. M. Blandford.*

Illinois.—The weather was rather cold, but generally favorable to farm interests. The precipitation was sufficient and well distributed in the northern and central districts, but was very heavy in the southern. Wheat remained in a generally excellent condition, the damage by hessian fly being less than previously estimated. In the southern portion of the State the snow covering was insufficient, and there were some fears that injury to the wheat resulted from the severe cold during the latter half of the month. Rye remained in good condition.—*William G. Burns.*

Indiana.—Wet weather and soft ground prior to the last week retarded field work and at the end of the month considerable corn and fodder were yet in the open. Wheat sown before September 25 was badly damaged by flies and there was some complaint of too rank growth of later plantings, but the bulk of the wheat crop was in good condition. Pasturage was good up to the 24th, when a cold wave spread over the State, followed by snow, and dry feed became necessary for all live stock.—*W. T. Blythe.*

Iowa.—Snow, ice, and rain, followed by extreme cold in latter part of month, made it difficult to complete the corn harvest, which had been retarded by the wet fall. Generally, however, the snow was favorable for grass lands and facilitated the usual farm work of the season.—*John R. Sage.*

Kansas.—The weather was favorable to growing wheat and rye, and both were in good condition at the close of the month, though in the southeastern counties, in fields not well drained, the wheat was injured; in the central-southern counties the wheat was being pastured. Damp weather has retarded corn gathering and much remains in the fields.—*T. B. Jennings.*

Kentucky.—Wheat was in excellent condition at the close of the month. There was little snow protection during the cold spell of the last week, but wheat had such a good start that it was not injured. There is little complaint of fly. Rye and oats were in good condition. Corn gathering was retarded by heavy rains which flooded many fields; some corn was damaged. Tobacco stripping progressed well and is nearly completed. Stock was in good condition.—*S. P. Gresham.*

Louisiana.—A large acreage of sugar cane was standing at the opening of the month. An unusually early freeze occurred on the morning of the 5th, when the minimum temperatures in the sugar region ranged from 27° to 30°. Warnings of this freeze were issued on the 3d, forty hours before its occurrence, advising planters to protect cane, and thousands of acres, worth millions of dollars, were windrowed and protected. Grinding continued throughout the month with satisfactory results, and is well advanced. Winter gardens made good growth.—*I. M. Cline.*

Maryland and Delaware.—The wet weather of the month prevented general farm work, particularly corn husking and fodder hauling. Some damage was done by water in lowlands, but otherwise wheat was still promising, having had a snow cover during the coldest weather; the fly continued in the early sown wheat. Fall sown grasses were well set. Fruit and forest trees suffered injury from sleet storms, especially from those of the 13th and 15th.—*Oliver L. Fassig.*

Michigan.—The weather conditions during December were generally quite favorable to winter wheat and rye; the ground was fairly well covered with snow during the most critical times. Wheat went under snow in generally good condition; there was some freezing and thawing, but correspondents generally agreed that little, if any, damage had been done.—*C. F. Schneider.*

Minnesota.—There were minimum temperatures below zero in some parts of the State daily from the 3d to the 14th, and from the 22d to the 30th. The lowest temperatures occurred on the 8th, 25th, and 26th. All the lakes were closed by ice early in the month. The precipitation was nearly all snow, and good sleighing was general the whole month. No work in the soil was possible.—*T. S. Outram.*

Mississippi.—High temperatures were general on the 2d and 3d, followed by a cold wave on the 4th, with sleet and snow in the northern portion of the State. Another warm period prevailed from the 10th to the 15th, terminating in a general and excessive rain on the 15th. The 26th and 27th were the coldest days, when the temperature reached 24° on the Gulf coast.—*W. S. Belden.*

Missouri.—December was generally cloudy, with frequent rains and snows and considerable sleet. Up to the 24th wheat suffered little or no injury from unfavorable weather conditions. During the severe freezing weather from the 25th to the 28th the ground was bare and in some counties it was feared the crop had been damaged, but in most sections wheat was reported in good condition at the close of the month. The month was very unfavorable for corn gathering.—*A. E. Hackett.*

Montana.—The temperature was uniformly low; no extremely cold weather occurred except in the northeast part of the State, but the temperature was below normal, with few exceptions, throughout the month, and at numerous stations, situated in various parts of the territory to the east of the mountains, the mean temperature was lower than during any December since observations began. The precipitation was very much in excess of the normal, and a large number of stations report the greatest amount on record during any December. Snows were frequent and heavy in the main range of mountains, in Flathead County, and in the northeast section. In other parts of the State the fall, as a rule, ranged from normal to slightly above normal. All stock being fed and some losses were occurring in northeast Montana.—*Montrose W. Hayes.*

Nebraska.—The cold, cloudy weather of December, accompanied by the snow which came early in the month and covered the ground quite generally most of the month, rendered it a most unfavorable time for farm work. Corn husking progressed slowly and considerable corn was still in the field at the end of the month. The covering of snow was very beneficial to winter wheat. The wheat plant is small but healthy and strong.—*G. A. Loveland.*

Nevada.—The month was moderately mild and unusually dry. The last few days were quite cold and very favorable for harvesting the ice crop. The weather conditions were remarkably favorable to stock interests.—*J. H. Smith.*

New England.—December was an unusually severe month, the weather in many sections being the coldest on record for this month. The precipitation was largely in excess of the normal but well distributed and mostly in the form of snow.—*J. W. Smith.*

New Jersey.—A good blanket of snow covered the ground in all sections, except the extreme southern, from the 5th to 15th and from the 25th to 30th, affording good protection to winter grain and grass. These crops are in good condition; no heaving of the ground from thawing occurred. The average depth of snowfall for each section was: Northern, 19.5 inches; central, 13.4; southern-interior, 3.2; sea coast, 3.2—*Edward W. McGann.*

New Mexico.—Storm of the 13–14th covered the central plains and the mountain ranges with from a few inches to 2 feet of snow, which was of immense value, although some slight loss to stock resulted.—*R. M. Hardinge.*

New York.—The month was considerably colder than the average December, and the snowfall unusually heavy in most sections. The ground was well covered almost continuously, affording ample protection to winter wheat and rye, which crops were in excellent condition at the close of the month. General thawing conditions prevailed from the 19th to 22d, but an immediate fall of snow prevented serious damage from freezing.—*S. L. Mosby.*

North Carolina.—While in some sections there was too much rain, which interrupted late seeding, the abundant moisture brought up all wheat and oats sown before Christmas and enabled plants to become well rooted. Severe cold about the 27th and 28th checked wheat but did not materially injure it; there was no protective covering of snow. Some oats were mown on account of too forward growth. Both oats and wheat at the close of the month were in excellent condition. Complaints of damage by hessian fly are not especially numerous.—*C. F. von Herrmann.*

North Dakota.—The month was generally favorable for stock running on the range, as it was able to feed on the prairie most of the time. No severe storms or long cold periods prevailed during the month.—*B. H. Bronson.*

Ohio.—Wheat was generally well protected by snow during the coldest weather and was reported in excellent condition in all sections. In a few localities the hessian fly was reported in early sown wheat, but the affected areas were probably very small. There was considerable corn to be husked. Stock continues in good condition. At the close of the month the ground was covered with snow in all sections.—*J. Warren Smith.*

Oklahoma and Indian Territories.—Cloudy weather, frequent precipitation, and occasional sharp dips in temperature marked the first half of the month, and caused conditions that delayed the progress of farm work and prevented the picking of late cotton. The latter portion of the month was fair and almost ideal winter weather, and permitted the progress of work to some extent. Wheat and oats were in fine condition. Pasturage was good and stock was doing well. Late cotton was badly damaged by recent rains.—*C. M. Strong.*

Oregon.—The weather throughout the month was wet and generally unfavorable for farm work. In western Oregon early sown fall grain made slow growth, but was reported to be in a promising condition. In the Columbia River Valley the condition of the grain crop was more favorable. In that portion of the State there was considerable snow, which protected the young plants from cold and frost, and as the ground did not freeze beneath the snow no damage resulted.—*Edward A. Beals.*

Pennsylvania.—The conditions as a whole were favorable for grain, which was generally well protected by snow during the colder periods, and at the close of the month both wheat and rye were reported as in satisfactory condition.—*F. F. Townsend.*

Porto Rico.—Conditions favorable for all agricultural interests prevailed generally and all crops made good progress. Preparation of land and planting for gran cultura were carried on as far as practicable. A number of sugar mills began grinding during the month, but the results were generally unsatisfactory, because of the low density of the juice. Young tobacco was slightly injured early in the month by dry weather and later by heavy rains, but the tobacco crop is now promising. All remnants of coffee crop gathered and pruning of the trees commenced.

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings:

Summary of temperature and precipitation by sections, December, 1902.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	45.6	−1.1	Bermuda	78	11	Hamilton, Newburg	8	27	5.77	+1.52	Letohatchie	9.20	Thomasville	2.50
			Valley Head		13									
Arizona	46.1	−0.5	Champies Camp	84	8	Fort Defiance	−16	16	1.71	+1.01	Pinal Ranch	4.62	Prescott	0.12
Arkansas	40.8	−1.9	Russellville	86	12	Oregon	5	26	5.71	+1.68	Marvell	10.20	Texarkana	2.80
California	46.6	−0.5	Elsinore	89	8	Bodie	−19	28	2.96	−0.88	Crescent City	17.29	Bishop	0.03
Colorado	25.6	−1.7	Las Animas	75	9	Gunnison	−35	30	0.98	+0.12	Ruby	5.11	Fruita	0.17
Florida	60.1	+0.9	Avon Park	92	15	De Funiak Springs	17	27	3.77	+1.15	Sumner	14.93	Jupiter	0.71
Georgia	47.3	+0.2	Waverly	83	2	3 stations	12	27, 28	4.53	+0.64	Quitman	11.34	Blakely	2.17
Idaho	27.7	−0.2	Hailey	65	1	Soldier	−25	14	2.48	+0.50	Murray	7.10	Blackfoot	0.10
Illinois	28.3	−2.1	New Burnside	66	11	Lanark	−13	8	3.08	+0.81	Raum	7.16	Antioch	0.70
Indiana	29.7	−2.1	Madison	62	2	Northfield	−8	31	4.05	+1.34	Salem	7.25	Topeka	1.32
			Mount Vernon		11									
Iowa	20.1	−3.5	Albia	59	1	Estherville	−20	26	2.33	+0.85	Ridgeway	5.51	Ottumwa	0.67
Kansas	28.4	−5.0	McPherson	77	19	Garden City	−12	17	1.12	+0.22	Columbus	2.57	Viroqua	0.10
Kentucky	36.7	−0.7	Williamsburg	72	12	Scott	−3	31	7.36	+3.83	Leitchfield	11.97	Pikeville	4.07
Louisiana	51.2	−0.8	Donaldsonville	82	14	Lake Providence	18	27	5.13	+0.80	Lawrence	8.13	Oxford	2.10
Maryland and Delaware	33.3	−1.7	Easton, Md	70	22	Deerpark, Md	−4	10	6.00	+2.79	Sunnyside, Md	8.63	Westernport, Md	3.07
Michigan	24.1	−1.5	Charlotte	59	4	Thomaston	−15	12	2.28	+0.16	Calumet	4.59	Owosso	0.61
Minnesota	12.6	−3.3	Currie	45	2	Pokegama Falls	−45	26	1.79	+1.09	Grand Meadow Mapleplain	3.19	Hallock	0.18
Mississippi	46.5	−1.7	Pearlington	80	3	Ripley	11	26, 27	5.68	+1.52	Austin	12.44	Indianola	3.90
Missouri	30.7	−2.4	Mount Vernon	68	1	Grant City	−7	26	2.91	+0.71	Caruthersville	9.31	Carrollton	0.94
Montana	19.9	−4.6	Helena	58	9	Culbertson	−32	12	1.10	+0.38	Troy	5.81	Deer Lodge	0.06
Nebraska	21.2	−4.6	Loup	68	1	Lynch	−23	26	1.40	+0.70	Kennedy	2.80	Bluehill	0.35
Nevada	33.7	+3.2	Martins Ranch	78	25	Potts	−2	3	0.35	−0.97	Lewers Ranch	2.79	5 stations	0.00
New England	23.0	−4.7	Provincetown, Mass.	61	1	Van Buren, Me	−30	13	5.32	+1.81	Southington, Conn.	8.55	Cornwall, Vt	1.44
New Jersey	31.7	−2.5	Indian Mills	62	3	Layton	−11	15	7.23	+3.65	Belvidere	8.99	Cape May City	5.81
New Mexico	34.4	+0.5	Carlsbad	82	5	Taos	−9	15	1.03	+0.35	Fort Bayard	3.11	Olio	0.12
						Las Vegas		16						
New York	23.4	−3.6	Middletown	59	3	Axton	−30	9	4.20	+1.13	Wappingers Falls	9.25	Avon	1.40
North Carolina	41.8	−0.6	Sloan	76	3	Linville	0	28	3.87	+0.01	Horse Cove	8.84	Edenton	1.78
North Dakota	7.8	−4.9	Jamestown	49	19	McKinney	−35	25	0.51	+0.12	Portal	1.55	Minnewaukon	T.
Ohio	29.4	−2.7	Portsmouth	63	3	Garrettsville	−11	31	3.95	+1.32	Hanging Rock	6.38	Bucyrus	2.10
			Pipley		20	Orangeville								
Oklahoma and Indian Territories	37.3	−2.3	Temple, Okla	74	10	Kenton, Okla	4	16	2.09	+0.19	Goodwater, Ind. T	4.86	2 stations	T.
Oregon	37.5	−0.2	Williams	70	9	Pine	−15	17	9.34	+2.88	Glenora	29.97	Umatilla	0.81
Pennsylvania	28.4	−3.3	Derry Station	68	3	Lawrenceville	−12	14	5.54	+2.48	Seisholtzville	8.51	Erie	1.97
Porto Rico	75.3	−0.3	Caguas	92	4	Barros	53	9	5.54	+0.68	San German	12.34	Guayamas	1.59
			Corozal		7									
South Carolina	46.8	+0.6	Seivern	85	19	Trial	10	28	4.26	+1.16	Conway	6.80	Bennettsville	1.92
South Dakota	13.9	−6.7	Fort Meade	70	10	Leola	−35	26	1.70	+1.14	Aberdeen	4.80	Grand River School	0.06
Tennessee	39.8	−0.1	Springdale	73	3	Liberty, Pope	5	27	6.49	+2.14	Kenton	10.53	Elizabethton	1.57
Texas	49.5	−1.1	Shaeffer Ranch	88	13	Mount Blanco	11	4	2.01	−0.20	Danevang	5.55	2 stations	0.00
Utah	26.9	−0.9	Hite	66	8	Loa	−25	14	0.89	+0.03	Ogden	2.11	Emery	T.
Virginia	37.9	−1.3	Boykins	72	11	Burkes Garden	3	27	3.69	+0.70	Ashland	5.94	Bristol	2.11
Washington	34.3	−1.5	Republic	64	26	Ellensburg	1	14	7.29	+1.83	Brinnon	22.45	Mottingers Ranch	1.01
West Virginia	33.9	−0.4	Williamson	70	21	Travellers Repose	−2	31	5.33	+2.16	Pickens	9.95	Greensulphur Spr'gs	2.01
Wisconsin	17.6	−2.2	Prairie du Chien	60	21	Osceola	−28	8	2.23	+0.63	Prairie du Chien	3.37	North Crandon	0.65
Wyoming	23.5	−0.5	Fort Washakie	63	9	Border	−35	15, 16	0.96	+0.23	Rawlins	2.11	Basin	T.
			Thermopolis											

Gathering and shipping of the orange crop progressed actively, crop good. Other fruits and ground provisions generally plentiful. Pasturage good and abundant.—*E. C. Thompson.*

South Carolina.—With a mean temperature slightly above normal and no decided cold weather until near the end of the month, and with ample and well distributed rainfall, farm work, incidental to December, made favorable progress. Oats did well and look promising. Late cotton began to open after the freezing weather set in. Trucking interests were favored by the weather. Some progress made in preparing seed beds for tobacco.—*J. W. Bauer.*

South Dakota.—The weather averaged unusually cold. The precipitation, principally snow, averaged considerably above the normal, except over the extreme northwest portion of the State. During the latter part of the month the unmelted snow very materially interfered with the grazing of live stock on the ranges, there being from 6 to 16 inches of snow on the ground on the 31st over the greater portion of the middle and eastern sections of the State.—*S. W. Glenn.*

Tennessee.—The month was favorable to winter grains, and at the close conditions were, as a rule, much better and prospects much more encouraging than usual at this period. However, excessive rains in the western section did much injury to crops on lowlands. The cold weather of the latter portion of the month had rather a beneficial effect, by checking the hitherto rapid growth. Grains were generally well rooted.—*H. C. Bate.*

Texas.—Frequent rains retarded farming operations to a great extent on the 4th and 5th, although breaking land for next season's crops was in fair headway at the end of the month. Freezing weather prevailed in all parts of the State, except along the immediate coast. Wheat and other cereals made excellent progress, having suffered little or no injury from the moderate freezes, and except in scattered localities where minor damage had been done by green bugs, rust, and excessive precipitation, these crops were most promising. Some wheat was yet to be sown. Cutting and grinding of cane was completed.—*Edward H. Bowie.*

Utah.—The farm work of the month was generally confined to caring for the stock and hauling manure. Range feed was very scarce, and in parts of the southern section was covered by snow. Stock generally continues in fair condition. The month was favorable for fall grain.—*L. H. Murdoch.*

Virginia.—The general weather conditions of the month were not favorable for crop progress. There was an excess of cloudiness and moisture and a deficiency in temperature, hence the soil was cold and wet, and the growth of winter wheat, oats, and clover, and fall sown grasses was retarded. Rust appeared in some early sown fields of wheat and oats toward the latter part of the month, and some injury from hessian fly occurred in the southwestern part of the State. Late seeding has suffered no material damage as yet.—*Edward A. Evans.*

Washington.—Although the mean temperature was below normal, yet east of the Cascade Mountains it was mild and uniform. In the western district it was a very wet month, while east of the mountains there were frequent light snowfalls, which afforded a good covering for winter wheat, except in the central counties. There was not a large stand of winter wheat, but what came up was doing well under the snow. The unusual amount of moisture in the ground affords a splendid prospect for spring crops.—*G. N. Salisbury.*

West Virginia.—Wheat has not been more promising in a number of years, and very little complaint was made of damage by fly. No hard freezing weather occurred until after Christmas, and then there was enough snow for protection. Rye and oats were also in good condition, as well as stock. Feed was generally plentiful, but in some counties there will be a shortage. Farm work was well up to date and some plowing done in several southern counties.—*E. C. Vose.*

Wisconsin.—The month was marked by some extremely low tempera-

tures, especially in the northern sections. Heavy snows prevailed during the entire month and served as an excellent protection to grains and grasses, and their condition continues generally satisfactory. No reports of freezing have been made.—*J. W. Schaeffer.*

Wyoming.—No severe cold wave visited the State during the month and no destructive storm. Over the southeastern quarter of the State a severe storm prevailed on the 19th, but as the duration of the storm did not much exceed twenty-four hours and no cold weather accompanied it, the loss of stock was practically nothing. The snowfall of the month was very unevenly distributed over the State, the southeastern quarter receiving the greatest average.—*W. S. Palmer.*

SNOWFALL AND WATER SUPPLY IN THE ROCKY MOUNTAIN REGION.

The following extracts are taken from the snow bulletins for December, 1902, issued by the Climate and Crop Section Centers in the Rocky Mountain region:

Colorado.—For the mountain region, as a whole, the snowfall during October, November, and December has been less than normal; but as compared with the corresponding period last year there has been an excess, except on the watersheds of the Grand, White, Yampa and North Platte. Since the depths will be materially modified by the later snowfalls, the reports furnish no information as to what the water flow will be during the early part of the season. The general outlook for late irrigation, especially on the eastern and southern slopes, is much better than for several years.

Idaho.—The snowfall throughout the State during November and December has been heavy. In many sections it has been unprecedented. In a few localities it has been less than the average. Correspondents, with few exceptions, have had no hesitancy in estimating the prospective water flow for the coming crop season. Considering that the snowfall has been heavy and that in many sections it is packed and of icy character, the prospect for water is excellent without the aid of additional snow during January, February, and March.

Montana.—On the eastern slope of the Main Divide the snow was exceptionally heavy from the boundary line as far south as the Lewis and Clarke Pass; storms were frequent, and high winds drifted the snow in ravines to a depth of 50 feet in some places; these drifts are packed solid, but as no thaws have occurred they are not frozen throughout. To the immediate south of the Lewis and Clarke Pass the snows have not been so heavy; in the vicinity of Bald Butte, however, a large amount of snow is again encountered—packed drifts 25 feet in depth; about an equal fall occurred on the Missouri River side of the Main Divide in Silver Bow and Beaverhead counties, but there the winds have been light, and drifts are not general nor deep. In the mountains of Madison, Gallatin, and Park counties the fall has reached about an average, and in some localities it is a little less; it has drifted, but the drifts are not solid. In the Crazy, Big Belt, Little Belt, Highwood, and Snowy mountains the fall has been comparatively light and in some cases a little less than last year. Considering the visible supply of snow on December 31, its condition with relation to drifts, etc., and the state of the ground when the first snow fell, the conclusion is reached that the amount of conserved water very generally exceeds that at the same time last year; in Teton and northern Lewis and Clarke counties the amount will be much in excess of the average.

Nevada.—At the close of the month there was more snow on the mountains in the western part of the State than a year ago, while at the headwaters of the Humboldt River a large deficiency is reported. If average weather conditions prevail during the remainder of the winter the water flow during the coming season will probably be greater than during that of 1902.

Utah.—In all the watersheds the depth of snow in the mountains was greater at the close of December than it has been at the same time during the past three years. In the Great Salt Lake watershed the depth is about average, slightly above in the Sevier Lake watershed, and much above in the Green and Colorado rivers watersheds. The snow is fairly well drifted and very solid for this time of year. An abundant water supply for the coming crop season is already assured to the Green and Colorado rivers watersheds, and even if the precipitation be somewhat deficient during the rest of the snowfall season, a good supply may be expected in the Great Salt Lake and Sevier Lake watersheds.

Wyoming.—The storms of December over the southern half of the State increased the stock of snow, so that by the close of December about the usual depths were reported from the Laramie, Platte, Green, and Snake rivers watersheds. The snowfall over the eastern slope of the Big Horn Mountains has been very deficient; all reports from that section show that the stock of snow is at present decidedly deficient, one report stating that the present depth is the least known in that section at this season during the past ten years.

SPECIAL CONTRIBUTIONS.

STUDIES ON THE METEOROLOGICAL EFFECTS OF THE SOLAR AND TERRESTRIAL PHYSICAL PROCESSES.

By PROF. FRANK H. BIGELOW, U. S. Weather Bureau, dated December 28, 1902.

THE SEMIDIURNAL PERIODS IN THE EARTH'S ATMOSPHERE.

The double and the single diurnal periods.—The problem of accounting for the well known semidiurnal periods in the meteorological elements, barometric pressure, vapor tension or humidity, and electric potential, as observed at the surface of the earth, is still awaiting its complete solution, but since additional information on the subject has been obtained in the past few years through the different kinds of observations in the strata at higher levels above the ground, this is sufficient reason for bringing the subject before this section[1] of the American Association for the Advancement of Science. Fig. 1 shows the average curves deduced from the surface observations, as they have been repeatedly made in all parts of the tropical and temperate zones.[2]

There are two minima and two maxima, the first minimum at about 4 a. m., the second at about 4 p. m.; the first maximum at about 10 a. m., and the second at 8 to 10 p. m. If the sun is supposed to rise and set at 6 o'clock, this indicates that the diurnal atmospheric processes lag several hours behind the hour angle of the sun, just as the seasonal processes lag about forty or fifty days behind the annual temperature changes. Since this retardation occurs chiefly through the slow radiation and convection of the atmosphere, just as the annual temperature wave lags in penetrating the ground through its slow conduction, so therefore, these retardations in the diurnal elements may become the means of calculating the coefficients of conductivity and convection in the air. Now it is to be noted that while the pressure, vapor tension, and electric potential give a decided double period, the diurnal actinic radiation from the sun shows only a small midday depression, and the temperature none at all, for this is a curve with a single maximum at 3 p. m. and a minimum at 4 a. m. This suggests the problem to be resolved, namely, the occurrence of single and double diurnal periods at the same time in the lower strata of the atmosphere.

In past years, before it was recognized that the single period prevails throughout the atmosphere, except in its lowest layers, efforts were made to account for the surface double period in two ways: (1) by referring it to a dynamic forced wave involving the entire atmosphere, as was done by Lord Kelvin, and (2) by seeking to explore the possible connections between the observed waves and the manometric waves due to temperature effects in the lower strata. The first of these theories must be abandoned for weighty reasons: (1) because the double wave does not exist throughout the atmosphere, as has been stated, but is confined to the lowest strata; (2) because the double wave system breaks at the latitudes 60° north and south, and reappears in the polar zones at right angles to that system,[3] with a change in the phase of 90°; and (3) because there is no known physical principle requiring the existence of any semidiurnal forced wave system. The second theory is not satisfactory because it has been found impossible to establish any positive synchronism in its details between the temperature changes and the corresponding diurnal variations of pressure due to manometric heat effects. Dr. Julius Hann for years sought to explain the phenomena along these lines, but was obliged to abandon the attempt and to accept Lord

[1] Read before the Physics Section, B, of the American Association for the Advancement of Science at the Washington, D. C., meeting, December 28, 1902.

[2] Compare pages 120 and 121 of my paper, Eclipse Meteorology and Allied Problems, Weather Bureau Bulletin I, 1902.

[3] International Cloud Report, chapter 9.

Kelvin's dynamic wave theory for want of anything better at hand.

Like so many other scientific problems which are difficult of solution, the trouble apparently lies in the fact that the necessary observations have not been made in the right place. It was supposed that the variations noted at the ground were

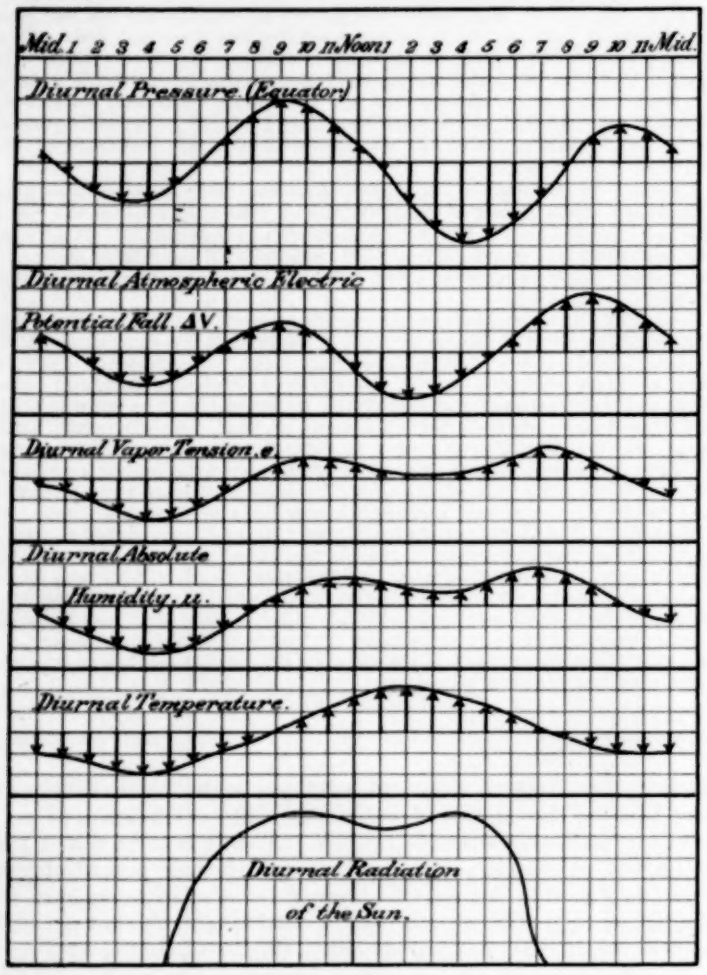
Mid. 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11 Mid.
Diurnal Pressure (Equator)
Diurnal Atmospheric Electric Potential Fall, ΔV.
Diurnal Vapor Tension, e.
Diurnal Absolute Humidity, u.
Diurnal Temperature.
Diurnal Radiation of the Sun.

FIG. 1.—Diurnal variations of the meteorological elements in the atmosphere at the surface of the earth.

common to the adjacent strata up to considerable heights, but since meteorologists have succeeded in getting some upper air observations, this supposition turns out to be contrary to fact, as is indicated by fig. 2.

Figure 2 is based on data that are now easily accessible, and we need not quote the authorities in detail. Generally speaking, when we go upward from the surface of the ground into the atmosphere, all the double diurnal periods become single periods, and this occurs at a comparatively low elevation. Thus at the top of the Eifel Tower the double periods greatly weaken or entirely disappear, and at the elevation of one or two miles, where the convectional ascents of the aqueous vapor contents of the air cease to form cumulus clouds, only the single period seems to exist. Thus the truncated actinometer curve with serrated top, fig. 1, becomes the parabolic curve, fig. 2, even at the surface when observed in very dry atmosphere; the barometric pressure curve and the vapor tension or the absolute humidity curves synchronize with the surface temperature curve, which itself retains the single period as high up as any diurnal variations occur, and the electric potential fall becomes a single period curve at surprisingly short distances above the surface. Finally, in the temperate zones the diurnal wind components, and the magnetic deflecting vectors of the earth's magnetic field, not only agree together as vectors constituting a single system, but they also synchronize in their turning points and phases with all the other elements just mentioned. It is impracticable to go through a full description of the local exceptions to the general conditions, but they form a most interesting study for the meteorologist who keeps in mind their significance in connection with the great cosmical problems in physics. Enough has been said to show that we need to fix our attention upon the cause of the transformation of the double period into the single period in the lowest strata of the atmosphere.

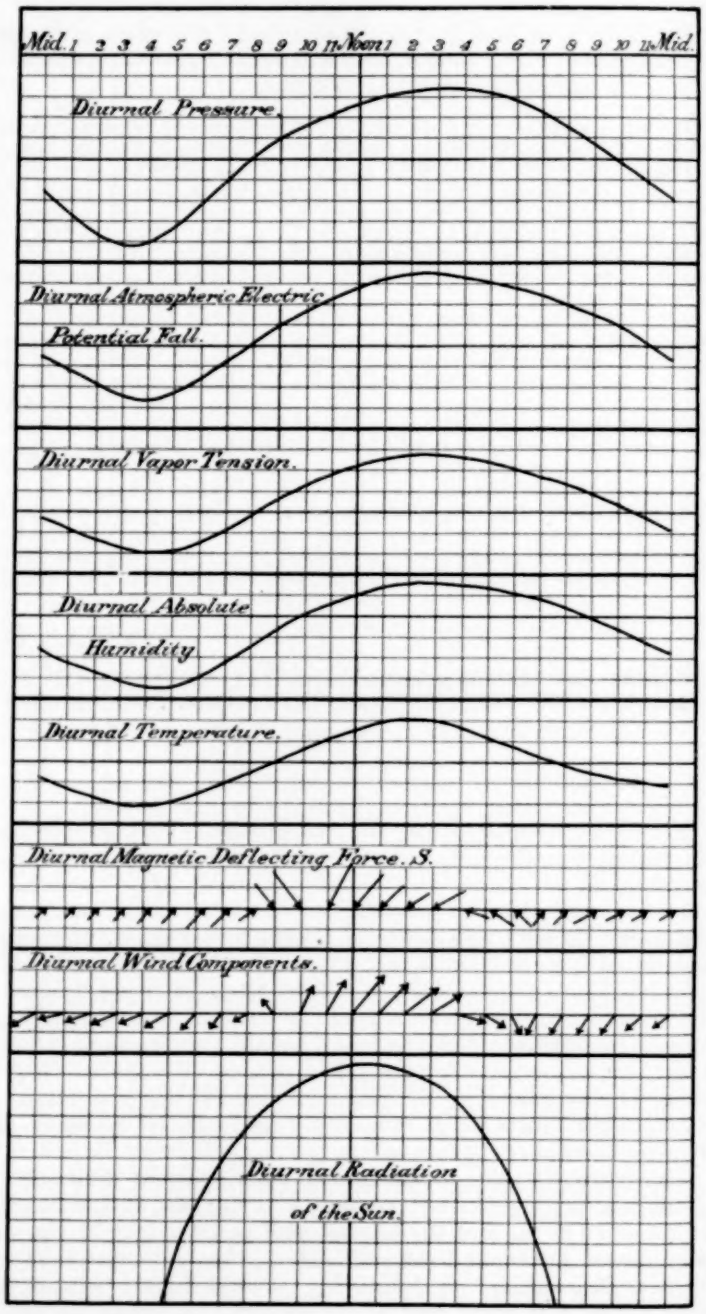
Mid. 1 2 3 4 5 6 7 8 9 10 11 Noon 1 2 3 4 5 6 7 8 9 10 11 Mid.
Diurnal Pressure.
Diurnal Atmospheric Electric Potential Fall.
Diurnal Vapor Tension.
Diurnal Absolute Humidity.
Diurnal Temperature.
Diurnal Magnetic Deflecting Force, S.
Diurnal Wind Components.
Diurnal Radiation of the Sun.

FIG. 2.—Diurnal variations of the meteorological, electrical, and magnetic elements in the atmosphere at some distance above the ground.

The solar radiation.—In my judgment there can be but one line of argument that needs to be discussed, namely, the behavior of the aqueous vapor in the presence of the solar and the terrestrial radiations. The water content of the atmosphere at any elevation is determined by the temperature and humidity of the air, and therefore the unit volumes containing equal vapor contents stand upon isothermal surfaces which

span the Tropics in great arches, stretching from the north polar zone to the south polar zone. These vapor contents rise daily from lower to higher levels during the forenoon and midday, but sink back again during the afternoon and evening hours. The process is well understood and it is briefly as follows: The incoming solar radiation of short waves penetrates the earth's atmosphere, with depletion of the short waves by selective reflection, and of the long waves by the absorption in the aqueous vapor; the earth's surface is heated by the residue of the radiation, and it then radiates like a black body at its own temperature, which being relatively low limits the outward radiation to much longer terrestrial waves than the incoming solar rays. The heat received at the surface also evaporates the water of the surface, heats the lower strata, and raises the isotherms by convection currents as well as by radiation, till at the average elevation of 1000 to 2000 meters the vapor tends to condense or actually forms the visible clouds. The outgoing radiation is also depleted by aqueous vapor absorption, and this with greatly increased vigor at the level where the water vapor turns into liquid water in the first stage of condensation. We have, therefore, a daily rise and fall of the vapor in the lower atmosphere, and it is the behavior of this vapor blanket which must be studied carefully to account for the transformation of the double daily into the single daily periods described above. But it will be desirable to examine a little more fully the peculiarities of the solar and the terrestrial radiations before going on to our conclusions.

Let J = the radiation from any single spectral line of a black body.

J_m = the maximum radiation occurring in the spectrum of a black body.

J_o = the total radiation throughout the whole spectrum from a unit surface of a black body.

λ = the wave length corresponding with J.

λ_m = the maximum wave length corresponding with J_m.

T_1 = the absolute temperature of the emitting body.

T_2 = the absolute temperature of the absorbing body.

A = the solar constant or the value of J_o at the distance of the earth from the sun.

R = the radius of the sun in kilometers.

d = the distance of the earth from the sun in kilometers.

Then we obtain by the Wien-Paschen formulæ in units of gram calories per cm^2 per second, per minute, and per day, respectively, the following equations:

Radiation function in the normal spectrum.

I. Radiation from a single spectral line in gram calories per cm^2.

$$J = \frac{dJ}{d\lambda}^{o} = c_1 \lambda^{-5} 10^{-\frac{c_2 M}{\lambda T}}$$

$$= \frac{9.292 \times 10^3}{\lambda^5 \left(10^{\frac{6277.4}{\lambda T}}\right)} \frac{\text{Gr. Cal.}}{cm^2. \text{ second.}}$$

$$c_1 = \frac{1.277 \times 10^{-12} c_2^4}{6} = \frac{1.277 \times 10^{-12} (14455)^4}{6}$$

	Logarithms.
$= 9.292 \times 10^3$ per sec.	0.96811
$= 5.575 \times 10^5$ per min.	5.74626
$= 8.028 \times 10^8$ per day.	8.90462
$c_2 = 5 \times 2891 = 14455$	4.16002
$c_2 M = 14455 \times 0.43429 = 6277.4$	3.79780

II. Total radiation of a black body.

$J_o = 1.277 \times 10^{-12} (T_1^4 - T_2^4)$	$\frac{\text{Gr. Cal.}}{cm^2.}$	per sec.	8.10619—20
$= 7.662 \times 10^{-11} (T_1^4 - T_2^4)$	"	per min.	9.88434—20
$= 1.1033 \times 10^{-7} (T_1^4 - T_2^4)$	"	per day.	13.04270—20

The solar constant $A = J_o \times \frac{R^2}{d^2}$

$= J_o \times 2.1643 \times 10^{-5}$ per min.		5.33532—10
Radius of the sun.	$R = 695\,500$ kilometers.	5.84230
Distance of earth from sun.	$d = 149\,500\,000$ kilos.	8.17464

$$A = 7.662 \times 10^{-11} (T_1^4 - T_2^4) \times 2.1643 \times 10^{-5}$$

$$= 1.6583 \times 10^{-15} (T_1^4 - T_2^4) \text{ per min.} \quad 5.21966—20$$

III. Maximum radiation in a normal spectrum.

$$J_m = \frac{c_1 5^5}{c_2^5 10^{5M}} T^5 = \frac{5.575 \times 10^5 \times 5^5}{(14455)^5 10^{2.17145}} T^5$$

$= 3.1004 \times 10^{-16} T^5$ per sec.	4.49141—20
$= 1.8602 \times 10^{-14} T^5$ per min.	6.26956—20
$= 2.6787 \times 10^{-11} T^5$ per day.	9.42792—20

IV. $\frac{J_m}{J_o} = \frac{3.1004 \times 10^{-16} T^5}{1.277 \times 10^{-12} T^4} = 2.4289 \times 10^{-4} T.$ 6.38522—10

V. $\lambda_m T = 2891.$ 3.46105

(Eclipse Meteorology and Allied Problems, page 164.)

From formula IV we have the following equation:

$$J_m = 0.00024 \; T \times J_o.$$

Hence, for

$T = 100°$; $J_m = 0.024 \; J_o$; and $J_o = 42 \; J_m$.
$T = 1000°$; $J_m = 0.24 \; J_o$; $J_o = 4.2 \; J_m$.
$T = 10000°$; $J_m = 2.4 \; J_o$; $J_o = 0.42 \; J_m$.

That is to say for low temperatures the total radiation J_o is much greater than the maximum radiation J_m, but for high temperatures J_o becomes less than J_m. Since J_o is the integral of the area of the curve of energy intensity, it should evidently be greater than J_m under all circumstances, but the fact that by this formulæ (IV) it becomes less for temperatures above 4119° seems to indicate that there may be something wrong in the deduction of the formulæ III for J_m and II for J_o, from which IV for $\frac{J_m}{J_o}$ was derived. These formulæ and constants have been tested by numerous experiments, and they appear to be satisfactory for temperatures up to about $T = 1500°$. It is noted that there is a tendency for the coefficients c_1, c_2 to change in passing from low temperatures and long wave lengths ($T = 273°$ to $750°$) to higher temperatures and longer wave lengths ($T = 750°$ to $1500°$). Compare page 164, Eclipse Meteorology. At all these temperatures the ratio J_m/J_o seems to be normal, but at the higher solar temperatures this is no longer the case. It may therefore be the fact that the extrapolation to such temperatures as $T = 7000°$ to $8000°$ is not allowable without a considerable change in these constants, or even in the exponents of the formula. It may be that there is a breakdown in the molecular structures of so-called black bodies at very high temperatures, which causes them to emit quite different spectra curves from those which we have computed by these formulæ. If this point of view is correct, it will be necessary to move very cautiously in computing the value of the solar constant, at the distance of the earth, from formulæ deduced in our laboratories and applied to the sun as to a common black body.

By means of these formulæ we construct the solar and terrestrial curves for various temperatures for the incoming radiation of the sun, supposing it to range from 8000° to 3000°; also for the outgoing radiation from the earth with a range of from 383° to 198° absolute temperature. The corresponding coordinates are given in Tables 1 and 2; they are also plotted graphically on fig. 3 for the sun, and on fig. 4 for the earth. On the solar curve for $T = 6000°$ is placed Professor Langley's energy curve as derived by the bolometer observations.

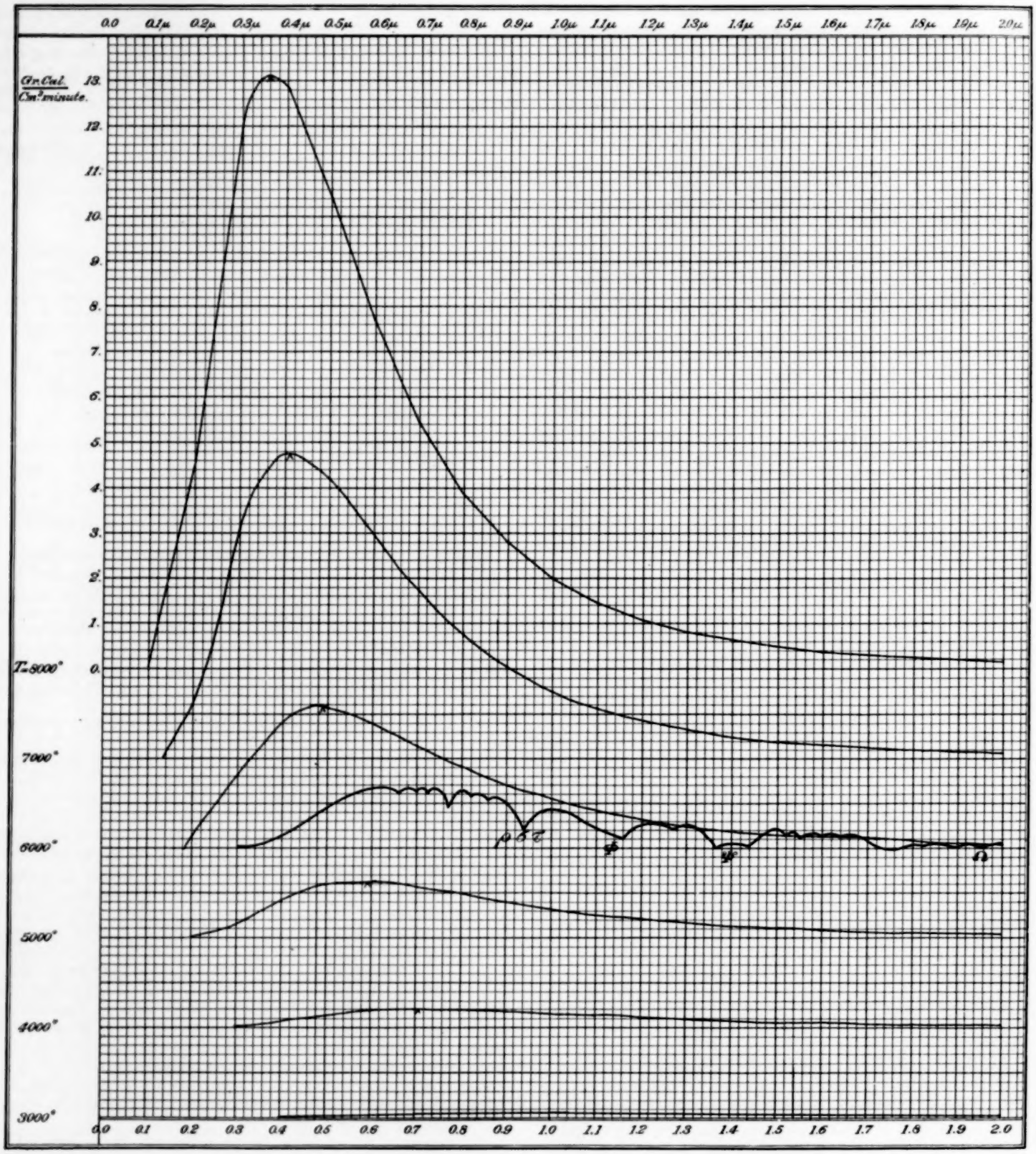

FIG. 3.—Energy spectra at solar temperatures reduced to the distance of the earth.

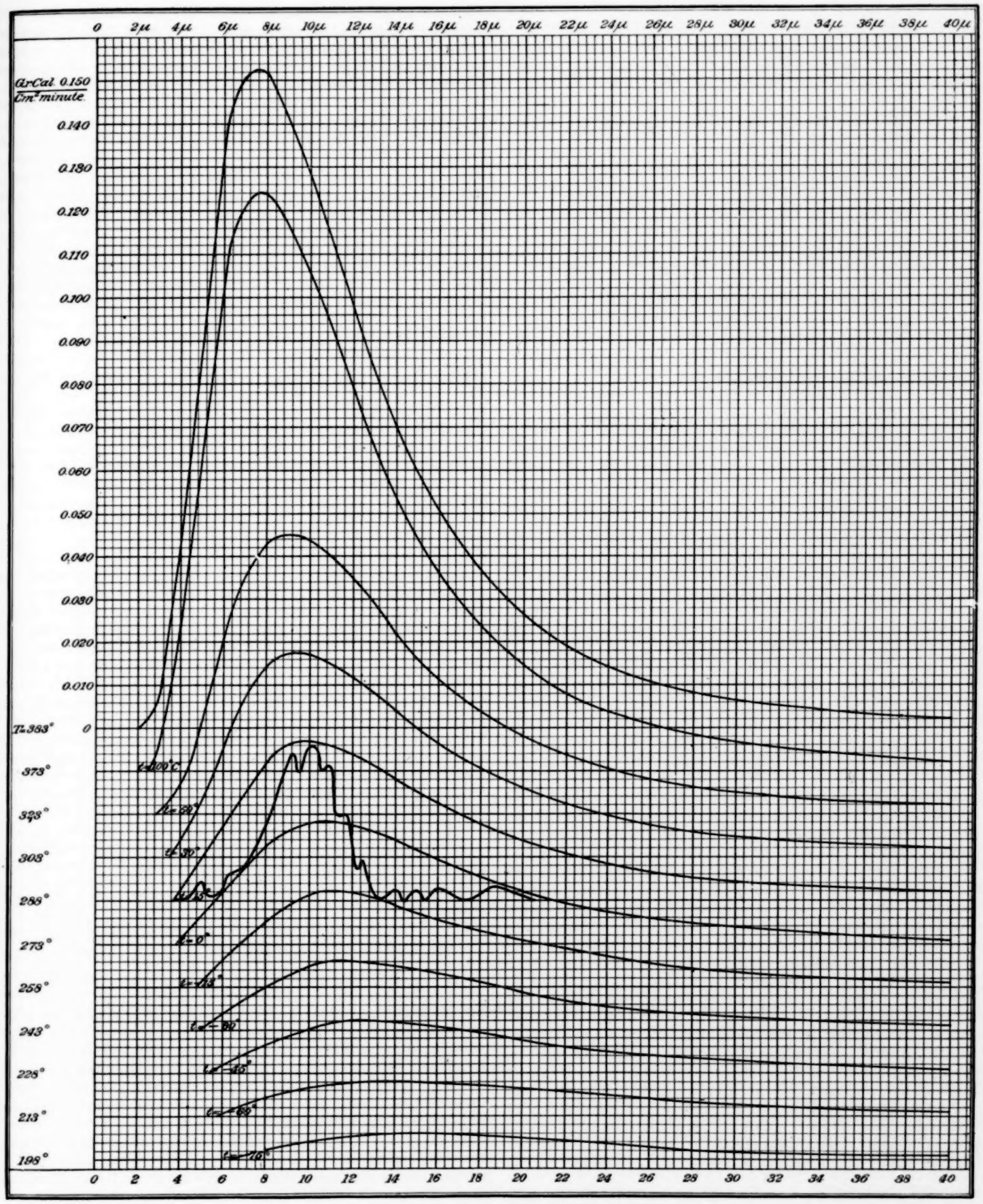

FIG. 4.—Energy spectra at terrestrial temperatures.

TABLE 1.—*Energy spectra at solar temperatures reduced to the distance of the earth, expressed in units of gram calories per square centimeter per minute.*

T.	8,000°	7,000°	6,000°	5,000°	4,000°	3,000°
$\lambda = 0.0\mu$	0.00					
0.1	0.02	0.00	0.00			
0.2	4.50	1.24	0.22	0.02		
0.3	12.03	5.09	1.62	0.32	0.03	
0.4	12.87	6.75	2.85	0.86	0.14	0.01
0.5	10.41	6.21	3.12	1.19	0.28	0.03
0.6	7.64	4.96	2.80	1.25	0.38	0.05
0.7	5.43	3.76	2.30	1.15	0.40	0.07
0.8	3.85	2.79	1.81	0.99	0.40	0.09
0.9	2.81	2.06	1.41	0.82	0.37	0.10
1.0	1.98	1.53	1.09	0.67	0.33	0.10
1.1	1.45	1.15	0.84	0.54	0.28	0.09
1.2	1.08	0.87	0.65	0.44	0.24	0.09
1.3	0.81	0.66	0.51	0.34	0.20	0.08
1.4	0.62	0.52	0.40	0.28	0.17	0.07
1.5	0.48	0.40	0.32	0.23	0.14	0.06
1.6	0.39	0.32	0.26	0.19	0.12	0.06
1.7	0.30	0.25	0.21	0.16	0.10	0.05
1.8	0.23	0.20	0.17	0.13	0.09	0.04
1.9	0.19	0.16	0.14	0.11	0.07	0.04
2.0	0.15	0.13	0.11	0.09	0.06	0.03
2.5	0.06	0.05	0.05	0.04	0.03	0.02
3.0	0.03	0.03	0.02	0.02	0.02	0.01
J_m	13.19	6.77	3.13	1.26	0.41	0.10
λ_m	0.36μ	0.41μ	0.48μ	0.58μ	0.72μ	0.96μ
A	6.79	3.98	2.15	1.04	0.43	0.13

$$J = \frac{5.575 \times 10^{1}}{\lambda^{5}\left(10^{\frac{6277.4}{\lambda T}}\right)}$$

J in units $\frac{\text{Gr. Cal.}}{\text{cm}^2,\ \text{minute.}}$

TABLE 2.—*Energy spectra at terrestrial temperatures, expressed in units of gram calories per square centimeter per minute.*

T.	383°	373°	323°	303°	288°	273°	258°	243°	228°	213°	198°
$\lambda = 2\mu$	0.000										
3	.008	.006	.001								
4	.044	.034	.007	.004	.002	.001					
6	.134	.113	.041	.025	.017	.011	.006	.004	.002	.001	.000
8	.152	.134	.063	.044	.032	.023	.015	.010	.006	.004	.002
10	.128	.116	.064	.047	.037	.028	.021	.015	.010	.006	.004
12	.097	.089	.055	.042	.034	.027	.021	.016	.012	.008	.005
14	.070	.065	.042	.034	.028	.024	.019	.015	.011	.008	.006
16	.050	.047	.032	.027	.023	.019	.016	.013	.010	.007	.006
18	.036	.034	.025	.021	.018	.016	.013	.011	.009	.007	.005
20	.027	.025	.019	.016	.014	.012	.011	.009	.007	.006	.005
22	.019	.018	.014	.012	.011	.010	.009	.007	.006	.005	.004
24	.015	.014	.011	.010	.009	.008	.007	.006	.005	.004	.003
26	.011	.011	.008	.007	.007	.006	.005	.005	.004	.003	.003
28	.008	.008	.007	.006	.005	.005	.004	.004	.003	.003	.002
30	.007	.006	.005	.005	.004	.004	.004	.003	.003	.002	.002
32	.006	.005	.004	.004	.004	.003	.003	.003	.003	.002	.002
34	.004	.004	.003	.003	.003	.002	.002	.002	.002	.002	.001
36	.003	.003	.003	.003	.003	.002	.002	.002	.002	.001	.001
38	.003	.003	.002	.002	.002	.001	.001	.001	.001	.001	.001
40	.002	.002	.002	.002	.002	.001	.001	.001	.001	.001	.001
J_m	.153	.134	.065	.048	.037	.028	.021	.016	.011	.008	.006
λ_m	7.55μ	7.75μ	8.95μ	9.54μ	10.0μ	10.6μ	11.2μ	11.9μ	12.7μ	13.6μ	14.6μ
J_e	1.649	1.483	0.834	0.646	0.527	0.426	0.340	0.267	0.207	0.158	0.118

Remarks on the solar constant.—This exhibit suggests some comments on the depletion of the short waves by selective reflection or scattering, and of the long waves through absorption by aqueous vapor. According to F. W. Very's discussions,[4] the selective depletion and absorption in the solar atmosphere of the radiation from the photosphere, may be due to four cooperating causes: (1) to a considerable extension of finely divided solar material in the outer corona to the distance of about one radius; (2) to scattering upon the molecules and other very fine particles especially in the inner corona; (3) to the passage through a columnar structure having different coefficients of transmission; (4) to emission from the uneven granular surface of the photosphere radiating at different temperatures. According to Professor Schuster's recent paper,[5] the depletion effect can be suitably explained by "placing the absorbing layer sufficiently near the photosphere and taking account of the radiation which this layer, owing to its high temperature, must itself emit." It is not proper to regard the radiating photosphere as of a single temperature, but as ranging somewhat, though not through many hundred degrees, with the depth of the strata, the lower being hotter; the coefficients of transmission vary with the wave length, and with the extent of path traversed, and therefore with the marginal distance of the ray from the center of the sun, the marginal transmission being rendered more efficient by early sifting out of the rays that are easily absorbed by the existing material. In the present stage of the problem it is difficult to assign the exact percentage of absorption due to the sun's atmosphere taken as a whole, and, from similar considerations, the percentage due to the absorption in the earth's atmosphere remains in doubt. Hence, it is not easy to derive the true temperature of the sun's radiating surface, even taken as an integral. Comparing the Langley curve with the energy curve for 6000°, it suggests that the short wave ordinates imply a temperature of about 5000°, but that the long waves at the same time require a temperature of rather more than 7000°, especially as indicated by those from 1.5μ to 1.7μ. Dr. Niles Ekholm[6] attempts to reconcile these conflicting facts by assigning a system of varying temperatures, $T = 5226 + 1000\lambda$, increasing with the wave length, till T equals 7226° for $\lambda = 2.0\mu$. While this brings the two curves nearer together throughout their extent there are two difficulties yet to be overcome: (1) the sun's atmosphere depletes short waves most in its lower strata, while the long waves escape more readily, some of them apparently quite unaffected. Since the short waves by Ekholm's hypothesis are assigned to lower temperatures, this implies that they are emitted only by the higher strata in the sun's atmosphere, and therefore it follows that they do not register the temperature of the photosphere at all accurately. Furthermore, the temperature in the solar atmosphere above the photosphere can not have a range of 2000°. (2) If the long waves which actually pass through both the atmospheres of the sun and the earth do possess energy ordinates corresponding to temperatures as as high as 7200° to 7500° they could not have been generated at all except at such high temperatures as these, and they in fact become an important index for determining the efficient photospheric temperature. It seems to me that since the long wave radiation at 1.5μ to 1.7μ requires a temperature of nearly 7500° we must let this fact control our conclusions, rather than depend upon the deductions to be derived from estimated percentage depletions of the short waves of the spectrum. It is noted that this gives a result nearly in harmony with the temperature $T = 7535°$, which was assigned by me to the photosphere from meteorological considerations (Eclipse Meteorology, page 81). Thus, in determining the hydrogen gas constant at the sun, we have,

$$R = \frac{p_o}{\rho_o T_o} = \frac{10333\ \text{(earth)}}{0.089996 \times 273°} = \frac{285185\ \text{(sun)}}{0.089996 \times 7535°} = 420.55.$$

Since p (sun) $= 10333 \times 27.6 = 285185$, it follows that $273° \times 27.6 = 7535°$, is the absolute temperature of the photosphere.

It was found that the rate of change of temperature from the photosphere vertically outward seems to be rather small, $\frac{dT}{dt} = -0.013°$ per 1000 meters, that is, about 300° from the the photosphere to the top of the inner corona, and this would indicate that we do not have in the sun's upper atmosphere such extremes of temperature to deal with as Ekholm's formula requires. But if we assign so high a temperature as 7535° to the photosphere, the depletion by scattering as shown by the diagrams of fig. 3 must be much greater than usually assigned, as is evident by comparing the curves, and we must also infer that the solar constant is really large in order to correspond to this temperature, namely, about 4.0 gram calories per square centimeter per minute at the outer limits of the earth's atmosphere.

[4] Atmospheric Radiation, F. W. Very, Bulletin G, Weather Bureau, 1900. The solar constant, F. W. Very, Monthly Weather Review, August, 1901. The absorption power of the solar atmosphere, F. W. Very, Astrophysics, September, 1902.

[5] The solar atmosphere, Arthur Schuster, Astrophysics, January, 1903.

[6] Ueber Emission und Absorption der Wärme und deren Bedeutung für die Temperatur der Erdoberfläche, Meteorologische Zeitschrift, January, 1902.

In the earth's atmosphere selective scattering takes place on the molecules of the constituents of the air, especially in the lower strata, and absorption occurs throughout the shell occupied by the aqueous vapor, but also chiefly in the lower strata. It is again difficult to assign the relative parts due to scattering and absorption, respectively. Prof. F. W. Very contends that the aqueous vapor of the higher strata first attacks the incoming radiation and depletes it very considerably and thus raises the temperatures of the high strata. Our international cloud observations, and the direct temperature readings in balloon ascensions seem to sustain this view. But Ekholm argues from the heat content of the atmosphere, assuming the solar constant of 3.0 calories, as follows:

	Calories.
Solar constant = 3.0 calories per minute	3. 00
40 per cent absorbed = 0.40 × 3.0	1. 20
Inward.—(1). The air receives one-fourth of this and holds it $\frac{432}{1440}$	= 0. 30
(2). Conduction to be neglected	0. 00
(3). Convection to be neglected	0. 00
Outward.—(4). From vaporization of aqueous vapor $\frac{164}{1440}$	= 0. 11
(5). Radiation from earth = 50 per cent, where the surface receives $\frac{1}{3}$ of 3.00 = 1.00 $\frac{98}{1440}$	= 0. 07
Total received per minute $\frac{694}{1440}$	= 0. 48

This corresponds to a mean temperature of the air 8.6° C., while the observed mean temperature is —17.0° C., or too low by 25.6° C. Ekholm says: "It follows that the supposed great absorption of heat by the atmosphere does not take place. But we must admit that the atmosphere absorbs directly only a small fraction of the insolation, and that it is chiefly warmed indirectly from the earth's surface." In a word, the aqueous bands absorb some little heat, while the air is nearly diathermanous to the rest of the energy spectrum. I shall, however, venture to raise the following inquiry. Ekholm seems to have assigned certain percentages for absorption, which of course are in the nature of a conjecture so long as the solar temperature remains in doubt, and a part of the discrepancy between the mean temperature of the earth's atmosphere as observed and as deduced from the solar constant, may be explained in that way. But, furthermore, he seems to compute the total energy received on the basis of a twenty-four hour radiation, and to have made no allowance for the fact that the earth receives only twelve hours of sunshine. The solar constant per minute when applied to the residual temperature of the atmosphere should have this fact included, but I am not able to decide from Ekholm's paper whether this was done in fixing upon his percentages. I infer, in any event, that the common procedure of extrapolating to the value of the solar constant on the outer atmosphere by using the spectrum throughout its entire length assigns too much weight to the short waves, which certainly suffer severely from scattering, and that on the other hand the few long undepleted waves 1.5μ to 1.7μ which are neither absorbed nor scattered, form the proper basis for deducing the true solar constant. Judging from these data it is probably not far from 4.0 calories, and the temperature of the photosphere must be about 7500°.

The terrestrial radiation.—If the energy line plotted on curve T = 288° of fig. 4 represents the observed earth's transmission through the air as described by Very (see Bulletin G, page 124), it seems to be in conflict with the view that the earth radiates like a black body of low temperature. The strong absorption from $\lambda = 4\mu$ to 8η is evidently due to aqueous vapor, but the much greater absorption area from $\lambda = 12\eta$ to 40μ is apparently not to be attributed to the same cause. It seems to me much more probable that the earth does not radiate these long waves like a black body, but is really deficient in them and emits freely only the waves from $\lambda = 4\mu$ to 12μ. On the other hand Ekholm[7] has drawn the curve from 11μ to 20μ in quite a different manner, by extrapolating from Langley's corrected observations on the moon's radiation, so as to follow the normal energy curve much more closely.

Since no observations exist to determine this point it may still be left open to doubt whether the waves are emitted or not. If they are really emitted, then the air must have other absorbing constituents that have not yet been attributed to it to satisfy Very's curve.

We may now study briefly the effect of the earth's long-wave radiation upon the meteorological elements, and explain the occurrence of the double periods at the surface and single periods at the cumulus cloud levels. If the scattering effect throws back into space a considerable percentage of the incoming radiation so that it does not reach the earth at all, on the other hand the absorption by the aqueous vapor of the terrestrial long waves tends to efficiently conserve the earth's temperatures which are high relatively to that of the interplanetary space, and at the same time it generates a series of interesting physical processes which can be described with at least approximate correctness. A field of research of unusual importance and interest is here presented to the meteorologist. The discussion of the temperature and vapor pressure observations which have been taken in the United States. during the past thirty years, is now going on at the Weather Bureau, and we hope to be able to make some further contributions to this subject by extending to the further study of the cloud formations those thermodynamic processes which were applied in a few cases in the International Cloud Report.

We adopt the hypothesis that aside from a moderate absorption of solar radiation by the aqueous vapor in the atmosphere, the waves pass through it unimpeded, except by scattering, which turns back a considerable percentage into space. The energy of the portion reaching the earth's surface is expended in raising its surface temperature. This increases from early morning till midday, with a lag of about two hours due to the slowness of propagation of the physical effects into the atmosphere, and then declines in the reverse order till midnight. The earth radiates in the forenoon something like a black body of gradually increasing temperature, the longest waves being possibly excluded, though their energy has not yet been mapped out beyond $\lambda = 12\mu$. The aqueous vapor depletes the outgoing radiation strongly in the waves 4μ to 8μ and probably from 12μ to 20μ. It is especially to be noted that when water vapor turns to liquid water in cloud condensation the power of aqueous absorption is increased a hundred fold, and thus the generation of clouds forms at the same time an absorbing screen at the cumulus level which practically confines the radiation emanating from the land and the ocean to the strata within a mile or two above the earth's surface. Carbon dioxide, CO_2, can absorb only its own peculiar rays, and as these constitute only a small portion of the spectrum their total effect is small compared with that of the aqueous vapor.

Explanation of the formation of the two types of diurnal periods.—Let us illustrate the formation of the double diurnal period at the earth's surface and the single period in the cumulus level by considering the behavior of the absolute humidity, that is the number of grams of water vapor per cubic centimeter. The first diurnal effect of the radiation from the earth is to raise the vapor content of the atmosphere from the low level

[7] Ueber Emission und Absorption der Wärme und deren Bedeutung für die Temperatur der Erdoberfläche. Nils Ekholm, Met. Zeit., November, 1902.

occupied by it at night to a higher level during midday. This absorbing screen of water vapor, visible or not, rises and falls once daily through 1000 or 2000 meters, taken as a whole. While the warm air rises by convection from the surface to the level of 1500 meters, the vapor rises with it and endeavors to saturate the unit volumes of the higher strata at the prevailing lower temperatures, the depleted lower volumes being *partially filled up again by fresh evaporation* from the water and land surfaces. Thus, in fig. 5, which represents the humidity

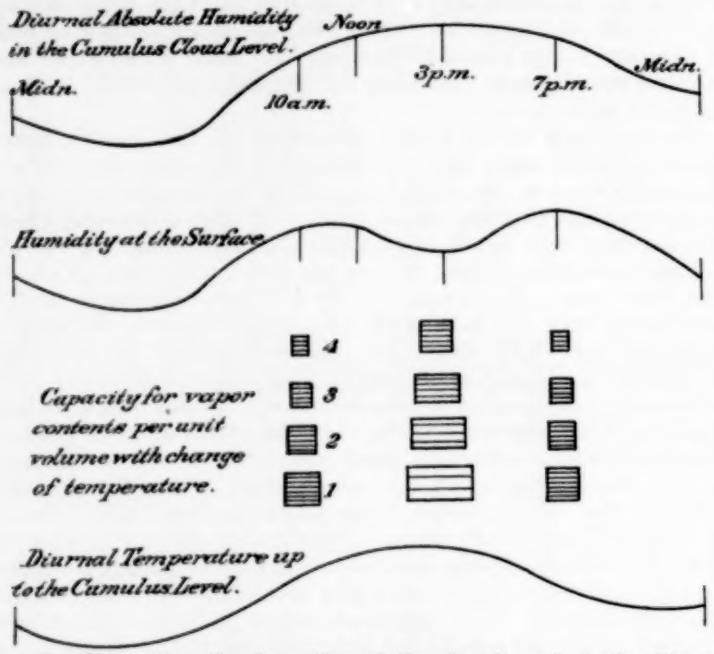

FIG. 5.—Illustrating the formation of the double and single diurnal periods of the absolute humidity.

variations at the earth's surface and at the cumulus level, and the temperature changes at all levels up to a moderate elevation of probably 3000 or 4000 meters, we may consider the behavior of the successive volume capacities arranged in vertical lines. There is a decrease in actual temperature with the elevation, and therefore the saturated unit-volume content decreases. The vapor sheet rises to higher levels, and this, together with the fresh supply by evaporation from the surface, can refill the depleted volume again, especially during the forenoon hours. After the noon hour the continued increase of temperature gives rise to larger vapor capacity per unit-volume, represented by larger areas on the diagram which are shaded more thinly and decrease upward in dimensions. But while the rising vapor sheet keeps the upper volumes filled, the lower, which are drained by the ascension of the water vapor, can not be supplied by evaporation at the surface at a sufficiently rapid rate to keep them full, because the prevailing surface moisture has been taken up at an earlier hour. The same remarks are true for the relative humidities. The result is that the upper volumes are always full, or relatively full, and have an increasing actual content up to the early afternoon, about 2 p. m., so that the diurnal curve at some distance above the ground has a single maximum and minimum as observed. On the other hand, while the 10 a. m. surface volumes are kept filled, or relatively filled, they are actually depleted in the afternoon and are not replenished by evaporation up to the original relative humidity of the morning, and therefore the curve shows a depression in the early afternoon, and is doubly periodic. The second maximum at the surface is due to a reversal of this process as the vapor settles back slowly to the ground during the afternoon and night. The additional lag of the evening maximum, being four hours in the evening to about 10 p. m., is due to the slow cooling of the ground after sunset, which continues to be a source of heat for several hours, and the slow conductivity of the heated atmosphere, which retains its heat even longer than the ground after the sun has set. This theory, if pursued into quantitative details will evidently account for the entire series of observed phenomena, and I hope to continue the study of this subject with such data as are now at the disposal of meteorologists. If we compare the areas of the complete actinometer curve of fig. 2 with that of fig. 1, as it is observed, the truncated portion must represent the heat energy that has been converted into work in carrying out these physical processes. Like an engine indicator-diagram, the difference between these curves can be translated as a function of the process concerned in the double diurnal periods in the lower strata, and thus become an important means of studying this function in the free atmosphere. If we could have suitable observations of the several elements at all levels up to 1 or 2 miles high, it would be a comparatively easy problem to discuss to a conclusion. At present the serious difficulty is to secure the necessary data since we must resort to more or less indirect methods.

The remaining elements may be treated for the change of period in a very few words. Analyzing the diurnal barometric pressure by volume contents we see that with the heating of the lower strata the denser air of night is replaced by contents of lower density after midday; taking into account the lag, the lower volumes are depleted and the upper are filled relatively, thus producing the two types of periods. This is entirely analogous to the barometric pressures of winter and summer wherein the summer pressures are lower at the surface of the earth, but greater at some such level as 1500 to 2000 meters, the summer pressure corresponding to that of the diurnal pressure in the afternoon. The later diurnal lag in the evening to 10 o'clock is a function of the cooling of the lower atmosphere by convection and radiation, and the settling back of the vapor sheet to the surface of the ground. The details of this phenomenon, as given in chapter 9 of the International Cloud Report, can all be shown to be in accord with this view, especially since the efficient vapor action caused by the lifting of the vapor sheet through radiation occurs outside the polar zones, and is greatest in the Tropics. It should be admitted that we do not yet understand the cause of the change of the phase of the diurnal barometric pressure which takes place in the polar zones. It is inferred from these considerations that since the double diurnal period is confined to a thin sheet near the surface, and does not extend throughout the atmosphere, Lord Kelvin's theory of a dynamic forced wave is not available for explaining this phenomenon. Dr. Hann's difficulties regarding the synchronism of the temperature with the diurnal barometric pressure will also probably disappear, because the local behavior of the vapor sheet in dry and moist localities will impose strongly modifying conditions upon the efficient action of the surface temperatures in respect to the two types of periods.

The fact that water vapor is a very powerful absorbent of given waves, and that this occurs chiefly in the cumulus level and not at the ground, indicates that it is the cloud temperatures which must be studied for synchronism rather than those of the free air near the surface of the earth. It is evident that a large task in observations must be executed by meteorologists before the details of these processes can be satisfactorily worked out.

From what was written in my report on Eclipse Meteorology and Allied Problems regarding the ionization of the atmosphere and the formation of electric potential, it becomes evident that temperature changes occur when the molecular structure of the aqueous vapor of the atmosphere undergoes modification by breaking up, at least temporarily, into atoms and ions. Since the transition from water vapor to liquid, in cloudy condensation, marks a sensitive condition, and since it is just at

this instant that the terrestrial (not solar) radiation is most absorbed, therefore all the conditions favor an excessive generation of ions and a change in the electric potential gradient. The fact that this element follows strictly the two type periods seen in the humidity and the barometric pressure makes it necessary that the absorption of energy and the ionization should be resultant functions occurring together in one general process. I believe that all the complex details observed regarding atmospheric electricity will be explained along these lines. Finally, in fig. 2, it is indicated that the diurnal deflecting wind components and the magnetic deflecting vectors of the earth's field are in close synchronism throughout the twenty-four hours, but by comparing them with the diurnal radiation of the sun and the temperature it is seen that they are simply parts of the single period system which is common to all strata of the atmosphere, except the lowest, in the three elements described, namely, the barometric pressure, vapor tension, and electric potential gradients. We infer, then, that since the double period depends strictly on the convectional rise and fall of the vapor sheet, the magnetic field is primarily more closely connected with the effects of the solar direct radiation throughout the atmosphere. What we lack in this connection is a series of observations to determine the variation of the magnetic components in the higher strata, which I doubt not will be found to be similar to those at the surface. In all respects it is evident that observation in the lower cloud region is as much demanded by the magnetician as by the meteorologist, to determine the subtle cross connections between the gaseous contents of the atmosphere and the electrical and the magnetical variations. But it seems to me very probable that the magnetic diurnal variations are due to a set of physical processes induced by the terrestrial radiation in the lower atmosphere. This may explain the fact that the incoming solar radiation does not seem to be the cause of the ionization which apparently precedes the generation of the electric and the magnetic disturbing forces. If this problem can be solved in the free air, it will probably also contribute important facts regarding our general knowledge of the relations between matter and ether. It is especially desirable to note that the facts which are now known indicate that the diurnal variation of the magnetic field of the earth is strictly a meteorological effect in the atmosphere, caused by the solar-terrestrial radiation, and that the order of production is (1) temperature, (2) electric potential, (3) magnetic deflection, somewhat as explained in Bulletin I, Eclipse Meteorology and Allied Problems.

HAWAIIAN CLIMATOLOGICAL DATA.

By CURTIS J. LYONS, Territorial Meteorologist.

GENERAL SUMMARY FOR DECEMBER, 1902.

Honolulu.—Temperature mean for the month, 70.8°; normal, 71.8°; average daily maximum, 75.9°; average daily minimum, 66.0°; mean daily range, 9.9°; greatest daily range, 18°; least daily range, 6°; highest temperature, 80°; lowest, 61°.

Barometer average, 29.938; normal, 29.970; highest, 30.11, 29th; lowest, 29.73, 10th; greatest 24-hour change, that is, from any given hour on one day to the same hour on the next, 0.10; lows passed this point on the 2d, 10th, and 21st; highs on the 5th, 14th, and 29th.

Relative humidity average, 77.7 per cent; normal, 75.7 per cent; mean dew-point, 63.1°; normal, 63.1°; mean absolute moisture, 6.39 grains per cubic foot; normal, 6.32 grains. There was an unusual period of low dew-point during the last ten days of the month.

Rainfall, 10.20 inches; normal, 3.92 inches; rain record days, 18; normal, 16; greatest rainfall in one day, 3.20, on the 22d; total at Luakaha, 26.50 inches; normal, 10.24 inches; total at Kapiolani Park, 7.81 inches; normal, 3.55 inches.

The artesian well level rose during the month from 33.90 to 34.57 feet above mean sea level. December 31, 1901, it stood at 34.05. The average daily mean sea level for the month was 9.87 feet, the assumed annual mean being 10.00 feet above datum. For December, 1901, it was 10.26. For the year 1902, 9.85. For the previous year, 10.17.

Rainfall data for December, 1902.

Stations.	Elevation.	Amount.	Stations.	Elevation.	Amount.
HAWAII.			**OAHU.**		
HILO, e. and ne.	*Feet.*	*Inches.*		*Feet.*	*Inches.*
Waiakea	50	15.40	Punahou (W. B.), sw.	47	10.20
Hilo (town)	100	15.48	Kulaokahua (Castle), sw.	50	8.94
Kaumana	1,250	.....	Makiki Reservoir	120	9.17
Pepeekeo	100	19.15	U. S. Naval Station, sw.	6	11.56
Hakalau	200	19.00	Kapiolani Park, sw.	10	7.81
Honohina	300	19.74	Manoa (Woodlawn Dairy), c.	285	15.75
Puuohua	1,050	34.84	Manoa (Rhodes Gardens)	300	21.02
Laupahoehoe	500	.....	School street (Bishop), sw.	175	.....
Ookala	400	23.48	College Hills	175	9.76
HAMAKUA, ne.			Insane Asylum, sw.	30	10.43
Kukaiau	250	24.99	Kamehameha School	75	10.94
Paauilo	750	29.25	Kalihi-Uka, sw.	450	21.35
Paauhau (Mill)	300	19.00	Nuuanu (W. W. Hall), sw.	50	10.38
Honokaa (Muir)	425	19.64	Nuuanu (Wyllie street)	250	13.28
Honokaa (Meinicke)	1,100	24.90	Nuuanu (Elec. Station), sw.	405	13.50
Kukuihaele	700	17.92	Nuuanu (Luakaha), c.	850	26.50
KOHALA, n.			Waimanalo, ne.	25	13.02
Niulii	200	14.87	Maunawili, ne.	300	19.45
Kohala (Mission)	521	13.62	Kaneohe	100	12.51
Kohala (Sugar Co.)	235	15.04	Ahuimanu, ne.	350	22.43
Puakea Ranch	600	10.43	Kahuku, n	25	11.85
Hawi	600	.....	Waialua	20	8.63
Puuhue Ranch	1,847	13.29	Wahiawa	900	.....
Waimea	2,720	16.84	Ewa Plantation, s.	60	5.14
KONA, w.			Waipahu	200	5.43
Kailua	950	.....	Moanalua	15	11.68
Holualoa	1,350	5.01	Laniakea (Nahuina)	1,150	15.00
Kealakekua	1,580	6.83	Tantalus Heights	1,360	17.04
Napoopoo	25	3.50	U. S. Experiment Station	350	10.69
Hoopuloa	1,650	3.78	Upper U. S. Exp. Sta. (Castle)	1,150	.....
KAU, se.			U. S. Magnetic Station	45	.....
Kahuku Ranch	1,680	4.69	**KAUAI.**		
Honuapo	15	5.38	Lihue (Grove Farm), e.	200	12.81
Naalehu	650	5.47	Lihue (Molokoa), e.	300	13.87
Hilea	310	8.20	Lihue (Kukaua), e.	1,000	19.17
Pahala	850	5.08	Vealia	15	.....
Moaula	1,700	.....	Kealia, e.	15	14.36
PUNA, e.			Kilauea, ne.	325	14.14
Volcano House	4,000	10.79	Hanalei, n.	10	27.64
Olaa, Mountain View (Russel)	1,690	20.95	Waioli	10	22.04
Kapoho	110	.....	Haena	15	.....
Pahoa	700	17.00	Waiawa	32	1.79
MAUI.			Eleele	200	3.83
Lahaina	200	5.37	Wahiawa	2,100	14.15
Waiopae Ranch	700	.....	Wahiawa (Mountain)	3,000	.....
Kaupo (Mokulau), s.	285	10.18	Lawai	200	5.18
Kipahulu, s	300	14.26	Lawai	450	7.97
Nahiku, ne	850	33.83	Lawai	800	7.37
Nahiku	1,600	.....	McBryde (Residence)	850	6.85
Haiku, n	700	14.70	*Delayed November reports.*		
Kula (Erehwon), n	4,500	9.93	Wahiawa Mountain	3,000	26.70
Kula (Waiakoa), n	2,700	5.31	Kealia	.....	7.33
Puuomalei, n	1,400	18.59	Kilauea, Kauai	.....	10.70
Haleakala Ranch	2,000	21.82	Grove Farm (Lihue)	.....	9.00
Wailuku, ne	200	7.96			

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

Trade wind days, 17 (4 of north-northeast); normal, 16. Average force of wind during daylight, Beaufort scale, 2.3. Average cloudiness, tenths of sky, 5.2; normal, 4.4.

Approximate percentages of district rainfall as compared with normal: South Hilo, 160 per cent; North Hilo, 250 per cent; Hamakua, 400 per cent; Kohala, 330 per cent; Waimea (Hawaii), 380 per cent; Kona, 300 to 400 per cent; Kau, 140 to 300 per cent; Puna, 175 per cent; Maui, 150 to 500 per cent; Oahu, 220 per cent, except Kahuku, 420 per cent; Kauai, 320 per cent.

The month was a rainy one, and the whole year's rainfall, when published, will show surprising records. The heaviest rainfall for the month was at Puuohua, 34.84 inches; the heaviest 24-hour, 10.55, at Hanalei, Kauai, on the 11th; Nahiku (850 feet), 8.90, on the 18th.

Mean temperatures: Pepeekeo, Hilo district, 100 feet elevation, mean maximum, 75.0°; mean minimum, 68.2°; Waimea, Hawaii, 2730 elevation, 74.3° and 58.2°; Kohala, 521 elevation, 75.8° and 65.1°; Waiakoa, Kula, Maui, 2700 elevation, 73.3° and 56.6°; Puunene Mill, Maui, 200 (?) elevation, 77.0° and 65.1°; mean temperature, 69.8°; Ewa Plantation, 50 elevation,

79° and 63°; United States Experiment Station, 350 elevation, 76.3° and 65.9°; W. R. Castle, 60 elevation, highest, 79°; lowest, 61°; mean, 70.0°; United States Magnetic Station, 50 elevation, mean, 71.1°.

Ewa Mill, mean dew-point, 61°; mean relative humidity, 71 per cent; Kohala, Bond, dew-point, 64.5°; relative humidity, 82 per cent; Puunene, 66.4° and 86 per cent; Puunene, pressure 29.91; United States Magnetic Station, dew-point, 63°; relative humidity, 77 per cent.

The month was characterized by four storms, which were no doubt general. One that came in on the 1st from the previous month; then on the 11th, 22d, and finally the heavy blow which characterized the last week of the year, and which was attended by an unusual spell of low dew-point, showing winds from the far north.

Mauna Kea and Mauna Loa were heavily covered with snow at the close of the month; the storm of the 11–13th being especially marked.

Heavy surf, 1st, 12th, 28th, as centers of surf periods.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18′ N., 157° 50′ W. It is the Hawaiian Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.)

Hawaiian standard time is 10h 30m slow of Greenwich time. Honolulu local mean time is 10h 31m slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, December, 1902.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.							Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		
	*	†	†			‡	‡		§		
1	29.91	70	69	80	66	68.3	87	ssw.	1–0	5–10	0.25
2	29.85	68	67.3	76	69	70.7	96	sw.	1–2	10	1.80
3	29.85	62	60.7	77	67	67.0	89	w-sw.	2–0	10	0.01
4	29.91	67	65	77	61	63.3	84	sw.	1–0	3	0.00
5	29.94	62	60	77	65	64.0	80	sw-w.	1–0	2	0.00
6	29.92	69	67	79	61	62.5	78	sw.	0	1–9	0.00
7	29.89	69	66	77	67	64.3	78	n-ne.	3	4	0.00
8	29.89	70	65.5	75	67	61.0	72	n-ne.	3–4	9	0.00
9	29.89	70	66	76	69	64.0	77	ne.	3	3	0.07
10	29.82	64	63.7	76	68	64.7	78	ne.	4–0	3–1	1.00
11	29.76	65	62.3	76	64	65.3	89	w-n.	1–0	2–8	0.80
12	29.89	67	65	73	64	59.7	73	n-nne.	6	9	1.40
13	29.94	69	66.5	72	65	64.5	82	ne.	4–1	7	0.15
14	30.02	70	64	76	67	65.7	84	ne.	3	6	0.84
15	30.07	71	66	75	68	58.7	64	ne.	3	3	0.00
16	30.04	67	66.3	76	70	65.3	77	ne.	3	4–10	0.05
17	30.00	66	65	80	66	66.7	84	ne-se.	1–0	4–10	0.00
18	29.94	73	68.5	78	65	66.7	82	s-n.	1–0	9	0.03
19	29.94	71	67	75	69	66.7	80	n-e.	1–0	10–8	0.14
20	29.89	65	64.3	79	69	65.7	80	s-n.	1–0	2–9	0.13
21	29.84	71	68	78	64	65.3	85	n-sw.	0	3–0	0.00
22	29.82	66	65.7	76	64	66.5	87	s-ne.	0	10	3.20
23	29.89	62	61	77	66	67.3	90	sw.	1–0	5–0	0.00
24	29.97	68	61.5	77	61	63.0	78	nne.	1–4	5–0	0.00
25	30.02	67	62	73	66	57.7	67	nne.	4	1–4	0.00
26	30.03	65	61	72	64	58.7	73	ne.	4	4	0.05
27	30.03	69	61	72	63	57.7	71	ne.	4–6	5	0.05
28	30.02	70	61.5	73	67	56.7	64	ne.	5–3	2–5	0.06
29	30.07	68	60.7	73	66	57.3	64	ne.	5–4	6	0.16
30	30.02	71	64.5	75	67	58.7	67	ne.	5–4	5	0.01
31	29.98	69	63.5	75	69	60.7	69	ne.	5–4	5	0.00
Sums											10.20
Means	29.937	67.8	64.4	75.9	66.0	63.1	77.7		2.3	5.2	
Departure	—.032					0.0	+2.0			+0.8	+6.28

Mean temperature for December, 1902, (6 + 2 + 9) ÷ 3 = 70.8; normal is 71.8. Mean pressure for December, 1902, (9 + 3) ÷ 2 = 29.938; normal is 29.970.

*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡These values are the means of (6 + 9 + 2 + 9) ÷ 4. §Beaufort scale.

Mr. Lyons also communicates Table No. 1 showing the rainfall at stations in the district of Hamakua, on the island of Hawaii. These stations are on a line from the north coast south southwestward toward the mountain of Mauna Kea, being on its lower slopes and at increasing elevations up to 5000 feet. They extend from the lowest station Kukaiau, at an elevation of 250 feet, southwestward toward the mountain top. The highest rainfall station is at an elevation of 5000 feet, but the summit of Mauna Kea is several miles farther on and at an elevation of 13,825 feet. We understand that the observations were originally communicated by Mr. J. M. Horner, of Kukaiau, to the Pacific Commercial Advertiser. Mr. Lyons notes that the rainfall is probably greatest at about 2000 feet elevation.

TABLE 1.—*Rainfall on the lower northeast slope of Mauna Kea.*

1902.	Kukaiau Mill.		Kainehe.		
	250 feet.	900 feet.	1450 feet.	3300 feet.	5000 feet.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	3.29	4.31	4.14	2.77	.....
February	3.52	4.72	13.09	2.55	.....
March	62.76	79.41	93.39	78.30	27.01
April	8.23	12.32	14.74	22.77	4.96
May	17.51	22.15	29.88	7.08	9.60
June	5.99	5.68	12.65	4.88	2.75
July	2.69	2.02	2.48	0.06	0.60
August	14.66	18.44	32.62	9.88	0.60
September	8.34	5.90	8.06	2.52	0.92
October	6.95	6.61	9.96	5.68	0.34
November	13.45	15.87	19.56	10.86	6.50
December	24.99	27.18	34.89	33.24	1.50
Total	172.38	204.61	275.46	180.59	*54.78

*For 10 months only.

The complete record for the above-mentioned station Kainehe, at the elevation of 1450 feet, and for nine years, is as in Table 2:

TABLE 2.—*Monthly rainfalls at Kainehe.*

Month.	Year.								
	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
January	3.00	6.31	12.84	6.67	28.42	.49	5.32	9.49	4.14
February	11.69	10.32	14.46	5.72	5.35	.74	10.14	8.60	13.09
March	21.49	28.21	20.43	4.41	30.35	19.70	4.85	25.66	93.39
April	6.90	39.48	12.84	4.32	8.05	15.84	11.62	3.57	14.74
May	.34	5.86	10.56	1.57	4.12	3.54	16.14	.46	29.88
June	2.35	1.25	6.26	2.03	2.05	2.81	3.48	.21	12.65
July	3.98	9.65	3.93	1.67	5.58	5.96	2.62	1.07	2.48
August	4.66	7.77	9.37	6.70	4.59	7.22	4.17	.26	32.62
September	.35	6.92	1.50	1.44	1.03	1.60	1.15	.70	8.06
October	2.84	3.67	6.41	.89	3.19	23.35	7.59	5.03	9.96
November	20.25	11.54	1.15	9.60	3.47	8.00	18.14	17.56	19.56
December	17.84	.57	11.17	7.60	10.99	.09	5.71	14.75	34.89
Totals	95.69	131.55	110.92	52.62	107.19	89.34	90.93	87.36	275.46

CLOUD BURSTS.

By H. H. TEN BROECK, Braidentown, Fla., dated September 26, 1902.

In the MONTHLY WEATHER REVIEW for May, 1902, page 265, there is an article on a tornado in which the writer mentions as one of the results the formation of hollows in the ground. Such facts are sometimes doubted. I have seen several such excavations, a dozen or more. They all occurred during storms of unprecedented precipitation; the excavations were about 15 to 20 feet in diameter and about 5 feet deep. On the hillside above them there was no more than the ordinary disturbance of the surface made by a heavy rain. The excavations were all well defined and at a short distance looked as though they were cellars dug for houses; those that I saw first I mistook for such cellars, and asked "Who is going to build?" but was told, "No one that we know of." I went to the spot and found two excavations, about 6 or 8 yards apart, on the side of a bluff. The evidence was conclusive that they were made by columns or spouts of water falling from the clouds on a slant; on one side the roots of the vegetation were turned over, as with a plow; on the other side they were undermined and hung over the hole. The earth, rocks, trees, etc., were

washed down the cliff and lay in a pile. There was no stream or running water anywhere near, no gulleys or ravines. Everywhere else the grass, leaves, twigs, etc., lay undisturbed on the ground, as they always do in such places. The only possible cause of the excavations was spouts of water falling on these places. I afterwards found a number of other similar excavations. These were all in Pierce County, Wis., near the Mississippi River, and were made in 1879.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

DECEMBER, 1902.

Notes on the weather.—On the Pacific side rains were generally in excess of the normal, and occasionally showers have interrupted the gathering and the preparation of the coffee. In San José the pressure was normal, the mean temperature slightly above the average, the humidity and rain scarce. On the Atlantic slope the weather did not show any special features. During the whole month the sunsets were characterized by their brilliancy, which was most remarkable on the night of the 9th. On that date the entire horizon was seen tinged with a deep fire-red color, the intensity of which diminished toward the zenith. The phenomenon began when the sun was about 5° above the horizon and lasted until about 9 p. m.

Notes on earthquakes.—December 8, $6^h\ 22^m$ a. m., slight shock NW-SE, intensity II, duration 9 seconds; $2^h\ 28^m$ p. m., slight tremors, NW-SE, intensity I, duration 3 seconds. December 9, 5^h a. m., shock NE-SW., intensity II, duration 6 seconds. December 10, $6^h\ 6^m$ a. m., tremors E-W, intensity I, duration 6 seconds. December 11, $3^h\ 7^m$ a. m., tremors. December 15, $5^h\ 5^m$ a. m., light shock ENE-WSW, intensity II, duration 6 seconds; $12^h\ 13^m$., p. m., tremors ENE-WSW, intensity I, duration 4 seconds. December 16, $4^h\ 6^m$ a. m., oscillatory movement, WNW-ESE, intensity III, duration 8 seconds. December 18, $4^h\ 13^m\ 22^s$ a. m., strong shock WNW-ESE, intensity IV, duration 5 seconds; $4^h\ 19^m\ 30^s$ a. m., strong shock ESE-WNW, intensity IV, duration 6 seconds; $5^h\ 35^m$ a. m., sudden shock ESE-WNW, intensity III, duration 4 seconds; $5^h\ 43^m\ 52^s$ a. m., slight shock WNW-ESE, intensity II, duration 3 seconds; $5^h\ 47^m\ 20^s$ a. m., tremors; $3^h\ 9^m$ p. m., slight shock, intensity II, duration 3 seconds.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——.

Scientific American. New York. Vol. 88.

Reynolds, Robert V. R. The Cause of Thunder. P. 41.

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Clayton, Henry Helm. A second Bishop's Ring around the sun and the recent unusual twilight glows. Pp. 150–152.

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Pender, Harold. On the Magnetic Effect of Electrical Convection. Pp. 34–48.

Callendar, H. L. On the Thermodynamical Correction of the Gas-Thermometer. Pp. 48–95.

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Heaviside, Oliver. Sound Waves and Electromagnetics. The Pan-potential. Pp. 202–203.

Dixon, Will A. Recent Dust Storms in Australia. P. 203.

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Langley, S. P. A Sub-Tropical Solar Physics Observatory. P. 207.

—— International Conference on Weather Shooting. P. 213.

Lockyer, William S. J. The Similarity of the Short-period Barometric Pressure Variations over Large Areas. Pp. 224–226.

—— Pilot Charts of the Meteorological Office. P. 235.

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Jefferson, M. S. W. Winter Aridity Indoors. Pp. 444–447.

—— Destruction of Hailstorms with Cannon. Pp. 457–461.

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—— An Old Scottish Weather Record. Pp. 169–172.

—— The Climate of the British Empire. Pp. 174–175.

Mossman, R. C. The Meteorological Equipment of the Scottish Antarctic Expedition. Pp. 177–179.

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Ward, Robert DeC. New South Wales Rainfall. [Note.] Pp. 427–428.

Ward, Robert DeC. The Last Word on "Hail-Shooting." [Note.] P. 428.

Ward, Robert DeC. Meteorology of the Equator. [Note on article by Dr. Hann.] Pp. 428–429.

Ward, Robert DeC. Relative Humidity in Houses in Winter. [Note on observations made by G. A. Loveland.] P. 429.

Ward, Robert DeC. Bibliography of Meteorology. [Note.] P. 429.

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—— Die Photographie eines Blitzes. P. 56.

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Klingelfuss, Fr. Untersuchungen an Inductorien an Hand der Funkentladungen bis zu 100 cm Funkenlänge in Luft von Atmosphärendruck. Pp. 1198–1216.

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—— L'émission des rayons cathodiques par le soleil. Pp. 508–510.

—— Exploration de la haute atmosphère. [Note on report by Assmann.] P. 534–535.

—— Agent radioactif émanant du sol. P. 535.

—— Cause de la période annuelle de l'aurore boréale. Pp. 535–536.

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G., J. F. L'air du Métropolitain. P. 18.

Laffargue, J. Éclairage électrique d'une villa. P. 23.

Darce, Léon. Un délesteur automatique pour ballons libres. Pp. 33–34.

Jean, Ferdinand. Dosage de l'oxyde de carbone et de l'acide carbonique dans l'air. Pp. 50–51.

T., A. Exposition aéronautique au Grand Palais. P. 62.

Reverchon, L. La neige dans le Jura. Pp. 71–74.

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THE METEOROLOGICAL SERVICE OF SERVIA.

Miss R. A. EDWARDS, Library, Weather Bureau.

The Central Observatory of Belgrade, Servia, under the di-

rection of Mr. Milan Nedelkovitch, has recently issued the first five numbers, January to May, 1902, inclusive, of the Bulletin Mensuel de l'Observatoire de Belgrade, which, with the Annales, to be published at the close of 1902, will constitute the regular publications of the observatory.

From the introduction to the first number of the Bulletin Mensuel and the circular letter accompanying it, we learn that the Annales will contain, in addition to the record of the work for the year, full information regarding the Observatory of Belgrade and its system of meteorological stations, including the history of the meteorological service.

The present meteorological service of Servia appears from the Bulletin Mensuel to have had its beginning in an observatory of a somewhat provisional nature establised in Belgrade in 1887 by its present director, in connection with the chair of astronomy and meteorology of the faculty of sciences. The modest appropriation of but $400 per year sufficed for its maintenance at that time. This observatory has passed through certain crises which greatly retarded its growth. However, governmental recognition was at length received in 1889, and authority granted by the state for the organization of a system of meteorological stations of the second order. In the succeeding years, stations of the third and fourth order were added.

In May, 1891, the Central Observatory of Belgrade was established as the permanent successor of the provisional institution. It occupies a building especially constructed for it, near its temporary predecessor, in a large park of more than 2 hectares (about 5 acres) in the southwestern part of the city.

The work of the Servian Meteorological Service unfortunately suffered a serious interruption for several years through the illness of its director. At the present time, the personnel of the service is: A director, a chief assistant, two subassistants, three observers, six computers, and one telegraph operator. The stations are in number: 18 of the second order (4 of which are equipped with self-registering barometers, thermometers, and hygrometers), 44 of the third order, and 117 of the fourth order, making a total of 179 stations. The ordinary annual appropriation from the state is about $5600 for all expenses. It is interesting to note that in many, if not all places, the instructors in the primary schools and the employees in the grape nurseries act as meteorological observers and without extra compensation.

The Bulletin Mensuel is a valuable addition to climatological and meteorological records and to the increasing literature on those subjects.

AN EXPLANATION OF WIRELESS TELEGRAPHY.

By ALFRED H. THIESSEN, Local Forecast Official, dated December 24, 1902.

In this article wireless telegraphy means that method of telegraphy which has been recently built up from the researches of Maxwell and Hertz. In this kind of telegraphy a sending station is equipped with an apparatus for generating and transmitting electric waves and a receiving station is equipped with apparatus which will enable it to detect these waves. The phenomenon to be considered then has to do primarily with wave motion. *The essential feature of wave motion is that the disturbance in the medium is communicated from one part to adjacent parts periodically.* There is no actual transference of matter or of the medium, but of energy. To illustrate this last: Throw a chip on water agitated by waves; it will be observed that the chip will stay in one position while wave upon wave rolls under it. Thus, it is seen that it is the condition that is being promulgated and not the medium through which the transference of energy is effected.

A stone thrown into still water causes ripples that succeed each other in expanding circles; this succession of ripples constitutes a wave motion. When the clapper strikes the lip of a bell it starts the lip into vibrations which in turn cause waves in the air. In the first example the medium communicating the ripples or waves is the water; in the last example the medium is the air. When a lamp is lit, light radiates from it in all directions in a wave motion. Light is transmitted through space by means of some rarer medium, which is called the æther, and this is also the medium which transmits electric waves. This æther evidently fills all space and the interstices of all kinds of matter, but its physical properties are made known by reasoning upon the phenomena of light and electricity.

It is necessary to presuppose the existence of some such medium; for when energy is transmitted with finite velocity we can think of its transference in only two ways; first, by the actual transference of matter, as when a ball is thrown through the air; secondly, by the propagation of energy from point to point through a medium which fills the space between the two bodies. The body sending out energy disturbs the medium contiguous to it, which disturbance is communicated to adjacent parts of the medium, and so the movement is propagated outward from the sending body through the medium until some other body is affected.

When we say that energy is transmitted in a wave motion, then we predicate certain characteristics of the phenomenon. For instance, we know from observing wave motion in water that the wave may be reflected; also that when a crest meets a trough the phenomenon of interference occurs, and a calm results. It is so with sound, light, and heat; they may be reflected and refracted, and the phenomenon of interference may also be observed in each. We now know that there is an intimate relation between electricity and light; indeed, waves of electricity are of the nature of light waves, differing primarily as to wave length and frequency. Electric waves are propagated through the same æther as light waves and can be reflected, refracted, and be made to interfere with each other just as light waves do.

The simplest example of wave motion which is accessible for study is the pendulum. The pendulum, in fig. 1, when at rest assumes position *a*, but when set in motion it oscillates between positions *b* and *c*. When the arc of oscillation is small we have a close approximation to a simple harmonic motion which is the simplest form of wave motion. To show this motion graphically suppose that *x*, in fig. 2, moves around the circumference of a circle with uniform velocity, and that the line *xy* always remains perpendicular to the fixed line *bc*, then the movement of the intersection of *xy* with *bc* represents the motion of a pendulum or any other vibrating body having simple harmonic motion. Referring again to fig. 1, suppose the pen-

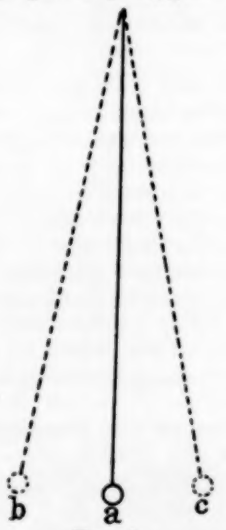


FIG. 1.

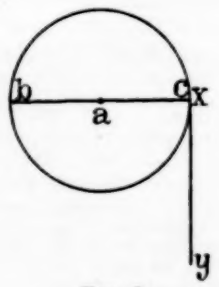


FIG. 2.

dulum bob is displaced to position b and set swinging, every time that it assumes the position b or c it is momentarily at rest; its motion or lack of motion in these positions corresponds to the motion of the intersections of xy with the line bc at the points b or c in fig. 2; for when xy is perpendicular to bc at b or c then the point of intersection is at rest momentarily; the moment of greatest velocity is at a, figs. 1 and 2. When the pendulum, fig. 1, makes a complete excursion c to b and back again to c, or in general when x, in fig. 2, makes a complete revolution, the time consumed is said to be the period of the vibrating body or particle. The number of vibrations occurring in a second of time is called the frequency; the greatest displacement of the pendulum from its position of rest is its amplitude.

It is commonly observed that a vibrating body sets up vibrations in another body, as for instance when one tuning fork responds to the vibrations of another when the tuning forks have the same note, or are in tune. The transmission of messages by wireless telegraphy is effected in much the same way. The apparatus at the sending station sends out waves of a certain period through the æther, and these waves are detected at the receiving station by apparatus attuned to this wave length or period.

To show how the vibrations of one body may set up vibrations in another at a distance, a simple apparatus will be described which the reader may readily set up for his own study. In fig. 3 ab and cd are two pendulums of exactly the same

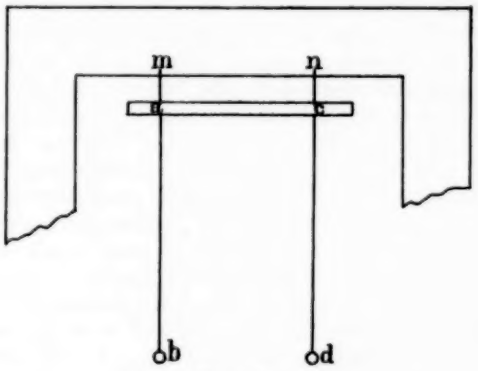


FIG. 3.

dimensions, about four feet is a convenient length; ac is a light stick of wood fastened to the top of a door frame by the cords ma and nc, each about three inches long. Bring both pendulums to rest. Suppose ab is the sending station. Start ab vibrating by giving it an impulse with the hand; cd, the receiving station, will then be seen to take up these vibrations. The medium in the above instance, transmitting the impulse, is the stick ac.

If a sound wave is started by disturbing the equilibrium of a sounding body as, for instance, when a guitar string is struck; then the resulting vibration of the string of the guitar agitates the air, this agitation or disturbance is passed on from one portion of the medium to the adjacent portion and so on until the disturbance reaches the ear drum. In general, in order to produce sound, the equilibrium of a sounding body must be disturbed, this in turn disturbs the equilibrium of the air which is the medium that transmits the energy to the drum of the ear.

In an analogous way electric waves are produced. Let A, fig. 4, be an insulated plate of some conducting material. Charge it with electricity by connecting it with some electrical machine. Now if another plate, B, figs. 5 and 6, which may or may not be connected to the ground, is made to approach A, then the intensity of the charge on A is increased, and B is oppositely charged, that is, if A is positively charged then B is negatively charged. An instrument in this form is called a capacity or plate condenser; it determines the capacity and is briefly called *the capacity*. If a plate of glass, G, in fig. 7, is placed between these two plates then the intensity of the charge is increased. Instead of the plate condenser, as shown in fig. 7, a form which is convenient is shown in fig. 8. It con-

FIG. 4.

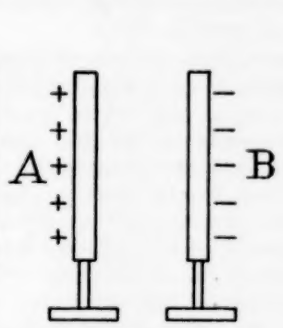


FIG. 5.

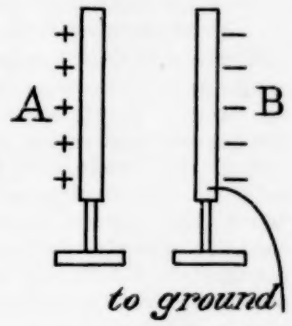


FIG. 6.

sists of a wide-necked bottle or jar, coated inside and out with tinfoil to within a few inches of the top. This form of condenser is called a Leyden jar, and may be charged the same as the plate condenser, by connecting one coating to an electrical machine and the other to the ground. The jar may be discharged by connecting both coatings with a piece of wire, as shown in fig. 9. H is a handle made of some insulating material to save the experimenter from a shock.

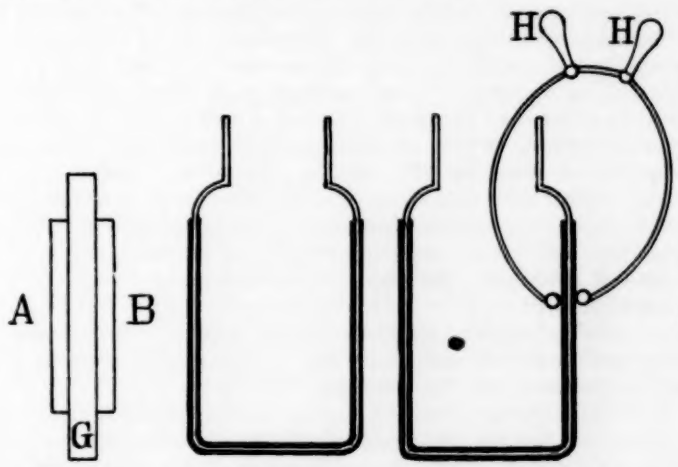


FIG. 7. FIG. 8. FIG. 9.

The discharge of the jar is oscillatory in character; that is there is no simple union of negative and positive electricity. What occurs is that the positive electricity rushes to the negatively charged coating and the negative electricity rushes to the positively charged coating, and these reversals rapidly follow one another, the intensity becoming less and less at each reversal, until finally electrical rest is reached, just as the amplitude of a pendulum at each swing becomes less and less until it attains mechanical rest. The oscillations in the jar are damped or gradually lessened on account of the electrical resistance in the circuit; the vibrations of the pendulum are also damped on account of the resistance to its motion by the friction at the point of suspension and the resistance of the air.

Since the discharge of the Leyden jar is vibratory, it has a certain time limit of vibration, that is, a definite periodicity called the tune, depending on the electrical constants of its circuit just as the periodicity of a guitar string depends upon its mechanical constants.

If T be the time of vibration of a stretched string, then:

$$T = 2rl\sqrt{\frac{\pi d}{tg}} \qquad (1)$$

where, r = radius of string.
l = length of string.
π = ratio of circumference to the diameter of a circle = 3.14159.
d = density of string.
t = tension or pull that stretches the string.
g = acceleration of gravity.

In the case of a Leyden jar the length of time required for an electrical vibration depends on three electrical constants of its circuit: First, resistance or that which resists the flow of the current and which depends on the dimensions and material of the conductor; it is more accurately defined as the ratio of the electro-motive force, namely, the force which causes the current, to the strength of the current; secondly, capacity, namely, that quality of a conductor by which it may accumulate electricity when in connection with an electric machine; thirdly, inductance or self-induction of the circuit; that is, when a current flows along a circuit, it sets up a magnectic field in the surrounding medium, which field generates an electro-motive force opposing the current; this is inductance and increases with the number of reversals of the current per second.

If T is the period of vibration in an electrical circuit, then:

$$T = 2\pi\sqrt{LS}. \qquad (2)$$

Where L is self-induction and S is the capacity. In this approximate equation the resistance has been omitted because in wireless telegraphy it is small compared to the capacity and and self-induction, and therefore is negligible. The capacity has its mechanical analogue in the reciprocal of the tension of the string, and the self-induction in the inertia of the string. By referring to equation (1) we see that to increase the period of the string, we may increase r, l, and d and so add to the inertia of the string, which is analogous to increasing L or self-induction in equation (2). Again we may increase the period of the string by increasing the reciprocal of the tension, t, which is analogous to increasing the capacity, or S in the equation (2). It is thus seen that by suitably varying the electrical constants the tune of an electrical circuit may be changed at will.

As the discharge of the Leyden jar is oscillatory, it may be compared to the vibrations of any body capable of oscillating, as to a guitar string for example.

When the guitar string is drawn to one side it is equivalent to charging the jar; letting it go, to discharging the jar. The string alternately assumes positions on either side of its position of equilibrium, just as the opposite coatings of the jar alternately become oppositely charged.

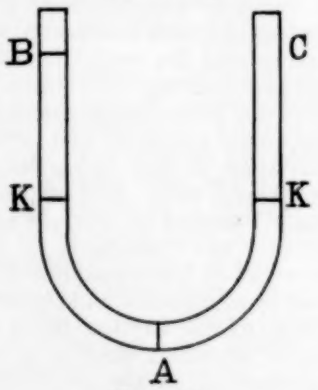


FIG. 10.

The diagram of another mechanical analogy is shown in fig. 10. BAC is a U-shaped tube with a stopcock at A. Close the stopcock, pour in water at one end, and let its level be at B; this may be likened to charging the jar. The B end of the tube may be considered the positively charged coating and the C end of the tube the negatively charged coating. Open the stopcock A, this may be likened to discharging the jar, and the water will flow into the C end of the tube; it will not at first assume equal levels in both legs of the U, but the inertia of the water will cause it to flow past K, the position of rest, and tend to fill up the C leg of the tube and empty the B leg. It will soon stop and flow back again. These reversals will continue until the friction of the walls of the tube, the internal friction of the water, and the resistance offered by the air in the tube cause the water to finally come to rest just as the pendulum comes to rest.

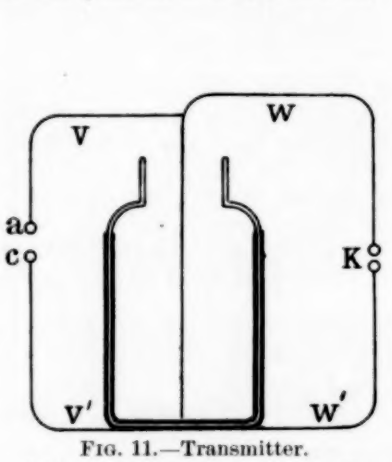


FIG. 11.—Transmitter.

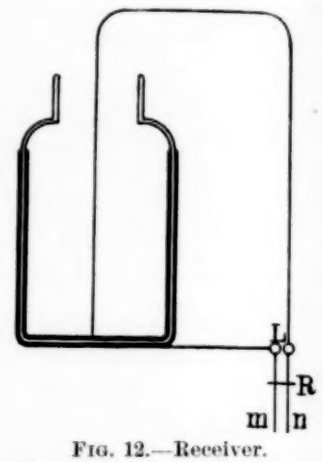


FIG. 12.—Receiver.

Now if the discharge of a Leyden jar be made through the wires W W' and the short spark gap K, as in fig. 11, then electric waves will be emitted to the surrounding medium. To the terminals a and c of other wires V V' may be connected an electrical machine for charging the jar, this constitutes a transmitter. If another jar with dimensions similar to those of the transmitter, fig. 12, be placed near, this constitutes a receiver; then the waves sent out by the transmitter may be detected by observing the sparks as they jump across spark gap L. This is a system devised by Lodge and one in which it is very necessary to obtain accurate tuning. Tuning may be obtained by sliding the short bit of wire on the so-called rider, R, along the conductors m and n. A change in position of R changes the time or value of T in equation (2).

The electrical machine used in producing the spark in wireless telegraphy and attached to the terminals ac, fig. 11, is called a Ruhmkorff or induction coil. It is shown schematically in fig. 13. M is a large piece of cylindrical iron or a

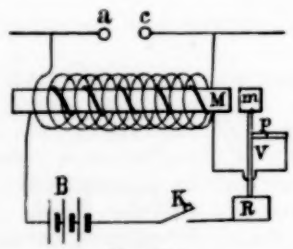


FIG. 13.

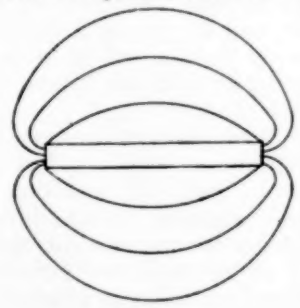


FIG. 14.

bundle of iron wires called the core. On M is coiled a layer of thick wire of only a few turns in all. This wire is called the primary coil. It is connected in series with the battery B, a key K, and a vibrator V. V consists of a steel spring clamped at R with a small magnet m at its free end, which magnet is directly opposite the large iron core M. A coil of fine wire consisting of many turns is coiled around the primary, and is called the secondary coil; it has its terminals at a and c. When the key K is depressed the current from the battery causes M to become a magnet and attracts m, this breaks the circuit at p

and the vibrator springs back to again make a contact, and so the breaking and making the circuit at p continues as long as the key is depressed. When the current is made then M becomes a magnet and a magnetic field is set up in its neighborhood, whose lines of force have the form shown in cross section in fig. 14.[1] When the current is made a magnetic field builds up around the core, and when the current is broken the field collapses. Every time the magnetic field is built up or is broken down, a current is induced in the secondary coil. This is why the primary current must be constantly interrupted at p by the vibrator. At each alternate make and break of the primary current, the current induced in the secondary coil is reversed. The potential is very large at the terminals ac of the secondary, and is larger than the potential in the primary in proportion as the number of turns in the secondary is larger than the number of turns in the primary.

In fig. 15 is shown diagrammatically the induction coil as it

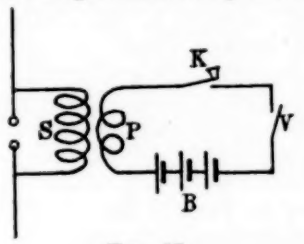


FIG. 15.

will be exhibited in the figures following. S is the secondary, P the primary, B the battery, V the vibrator or interrupter, and K the key.

Instead of a Leyden jar referred to in fig. 11 let there be substituted two spheres S and T sliding on rods, as in fig. 16,

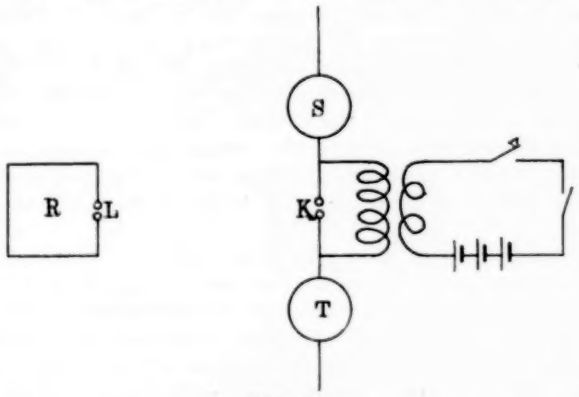


FIG. 16.

and let the two rods be connected to the terminals of the secondary circuit of an induction coil. When the spheres are charged above the sparking potential of the air gap then sparking occurs and electric waves are sent out. The spheres are as the two coatings of a Leyden jar or as the plates of condenser shown in fig. 5. In the present case they are separated by air instead of by glass. The Leyden jar in this form is capable of having its capacity altered by sliding the spheres along the rods, the nearer they are together the greater the capacity, and the farther apart they are the smaller the capacity, and thus the electrical tune may be changed. This style of transmitter is called a Hertz oscillator.

Hertz received the waves by the simplest kind of a receiver, as shown at the left of fig. 16; it consisted of a piece of wire bent into a square or circle. When sparking takes place at K, sparking will also occur at L, provided the spheres are properly adjusted so as to be electrically in tune with R. In actual practise the spark gap is 2 millimeters. The receiver was placed about 30 centimeters or more from the sending system.

[1] See any text-book on physics.

The more sensitive the receiver the farther could it be placed from the sender and still receive signals.

For the sphere S, in fig. 16, substitute a vertical wire; for the sphere T substitute the ground; that is to say, connect one secondary terminal to a large plate of copper in the ground; we shall then have the simplest form of sending system as used in commercial wireless telegraphy to-day; see fig. 17. The vertical wire applied to both sending and receiving apparatus is one of Marconi's great improvements.

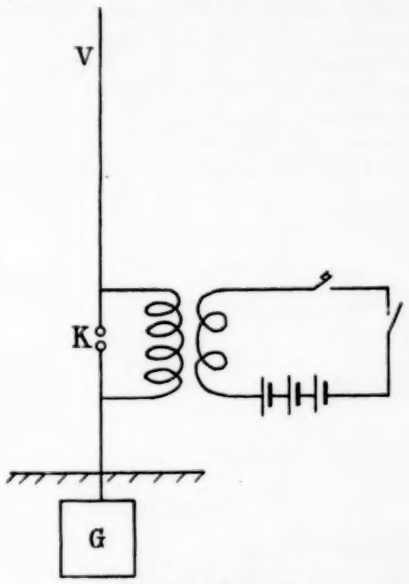


FIG. 17.—The transmitter.

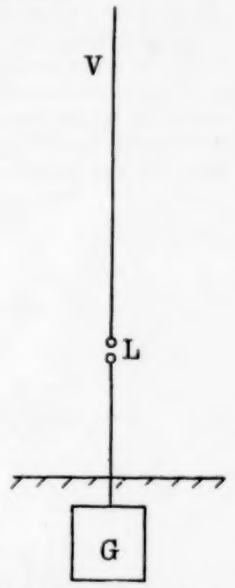


FIG. 18.—The receiver.

The simplest form of the receiving system is shown in fig. 18. V is the vertical wire, G the ground, and L the spark gap. When a wave is sent out from the sending station, as in fig. 17, sparking will take place at L, at the receiving station, fig. 18, if the intensity of the wave on arrival at the receiver is great enough to produce a spark that will jump over this small gap. In the ring receiver of Hertz the experimenter relies on his sight to detect the minute sparks which jump across the spark gap L. It is evident that with the same sending apparatus, but a more sensitive detector of the waves greater distances could be signaled over.

FIG. 19.—The coherer.

The coherer has been found to be quite a sensitive form of detector. It is shown full size in fig. 19. It consists of a glass or rubber tube with a bore of about one-eighth of an inch in diameter. Fitted very snugly in the tube are two plugs, PP, preferably of silver or platinum, about one sixteenth of an inch apart, leading out from which are two wires, TT. The space between the two plugs contains metallic filings; almost any metal will give results.

In fig. 20 is represented a receiving system showing the manner of inserting and connecting the coherer. The vertical wire V from a tall mast is connected to one terminal T_1 of the coherer, while the other terminal T_2 is connected to the ground; that is to say the spark gap L, in fig. 18, is replaced by the coherer. The terminals T_1 and T_2 are also connected to a sensitive relay, R, through a cell, B_1. The filings, when lying loosely between the plugs, have an infinite or very high resistance, the resistance depending on how tightly they are packed, so that by adjusting the plugs PP the resistance can be chosen so high that the cell B_1 can not work the relay R. Now, when an electric wave strikes the vertical wire V an oscillatory current is set up in this wire through the coherer to

the ground G; this current lowers the resistance in the coherer and thus permits the cell B_1 to work the relay R. The resistance of the filings in the coherer remains low even after the sparking at the sending end ceases, but it may be brought back to its original state of high resistance by simply tapping the coherer, and this is what is done in actual practise by the magnetic tapper m_1, which strikes the coherer tube from underneath, and so restores the filings to the original state of high resistance. This tapper is driven by the battery B_2, which works whenever the relay R brings its armature down so as to complete the connection at A. The relay R may also be made to work an ordinary telegraphic sounder or a Morse recording instrument, so that signals may be received either by sound or by written dots and dashes. In order to send signals the key (K, fig. 13) of the induction coil is depressed a very short time for the length of a dot and a little longer for a dash.

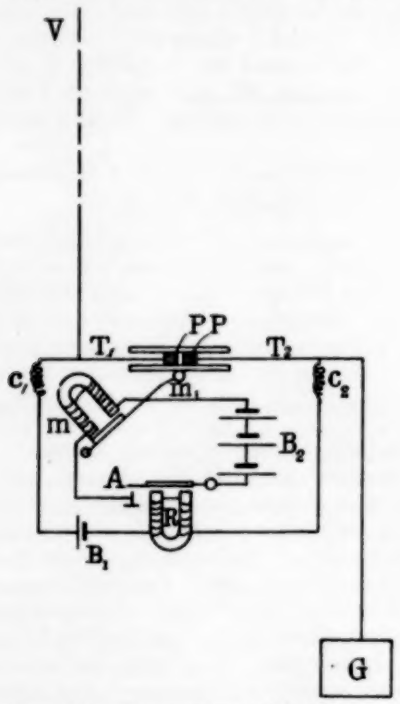


FIG. 20.—The receiver with coherer.

TUNING.

When the operator presses the key K in fig. 13, the vibrator of the induction coil begins to make and break the primary circuit rapidly. Each make or break starts oscillations in the secondary circuit which may be considered as dying out rapidly. These oscillations run up and down the vertical wire and from it analogous waves spread to the æther. These waves are shown in fig. 21 at $a\ b\ c\ d$ ....., $a'\ b'\ c'\ d'$ ....., $a''\ b''\ c''\ d''$ ..... The distance apart of a, a', a'' corresponds to the intervals between the makes and breaks of the vibrator, while the time period of the electrical oscillations $a\ b\ c\ d$ ....., etc., within the vertical wire are of the order of a millionth of a second.

The waves sent by such a transmitter, as shown in fig. 17, are exhibited graphically in fig. 21.

Let time be measured on line OT and the intensity of the wave transmitted on the line OI. The ordinates of a, a', a'' show the intensity of the oscillations at each successive make and break of the induction coil. It is seen that within four or five oscillations the intensity rapidly dies out and become inappreciable long before the vibrator can make another make or break, especially if the vibrator of the induction coil makes only a few vibrations per second. These vibrations die out rapidly because of the high resistance of the spark gap and the small capacity of the vertical wire, and also because a vertical wire is a good radiator and gives up its energy freely.

The corresponding vibrations set up in the receiving system, fig. 20, are shown in fig. 22. The scale of time is the same as in fig. 21, but the scale of intensity is increased many times in order to show the minute waves as they arrive at the receiving station. The vibrations in the receiving system also die out rapidly, and electrical rest is attained long before the waves sent out by the next break or make at the sending end can reach the receiving end.

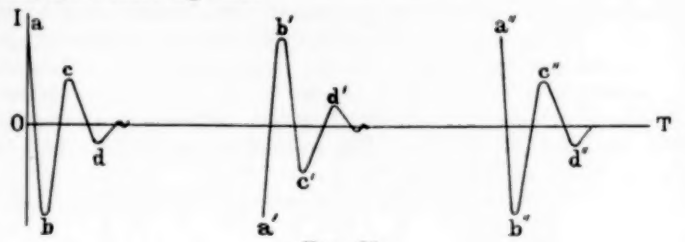


FIG. 21.

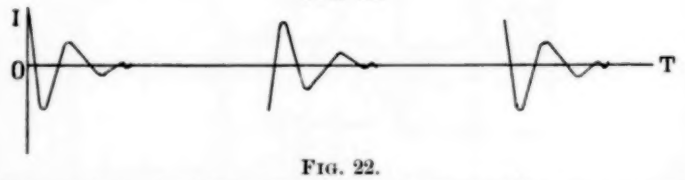


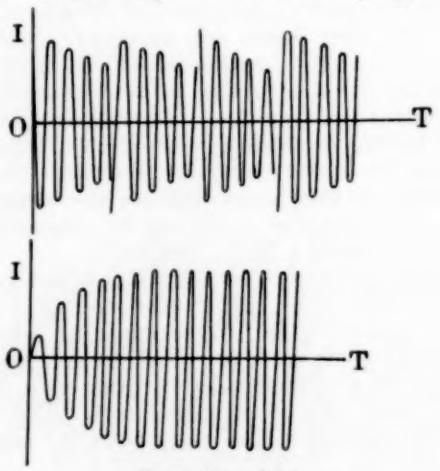
FIG. 22.

The systems just described are called "rapidly damped systems," that is to say, their oscillations die out very quickly. The mechanical analogue is a bell with a finger placed on its lip; when hit with a clapper the bell gives a large initial vibration, but the subsequent ones are feeble. It may be compared to a pendulum swung in a liquid.

It may now be seen that with this kind of a system it is not necessary to have accurate tuning, for by tuning is meant that the natural oscillations of the sending wire be the same as those of the receiving wire so that the oscillations of the latter may be strengthened, before they die out, by rapidly succeeding impulses sent out by the former. By a tuned sending and receiving system is also meant a system the receiver of which will not respond to waves of some other frequency, and the sender of which will not cause a receiver of different tune to respond.

To have accurate tuning one must employ a sending system which is a persistent oscillator, and also a very rapid break and make device so that the trains of waves succeed each other very rapidly. The receiving system must also be a persistent oscillator so that before the oscillations set up in it by a preceeding train of waves die out, they may be increased by the succeeding trains of waves.

The conditions of oscillations to be satisfied in a tuned system are shown graphically in the following figures:



FIGS. 23 and 24.

Fig. 23 represents the vibrations in the transmitting system and the waves sent out will have, of course, the same character. It is seen that before the oscillations completely die out another impulse is given, and that the several trains of waves succeed each other rapidly.

Fig. 24 represents the vibrations induced in the receiving system, it shows the additive effect of all the separate waves which build up the oscillations in the receiving system until they finally break down the resistance in the coherer and a signal is heard.

In fig. 11 the transmitter has persistent oscillations, and it is therefore one adapted for a tuned system, but it is a feeble radiator. In fig. 17 the system shown is a good radiator, but is almost "dead beat"; that is, very rapidly damped. If wires, *V* and *U*, be bent and connected up to a condenser, as shown in fig. 25, it forms a persistent oscillator but a feeble radiator, and is of exactly the same construction as shown in fig. 11. As this construction is a feeble radiator, then a similar construction at the receiving station would also be a feeble absorber, and the system would not be adapted for long distances.

If near the rectangle *VU*, fig. 25, a vertical wire be placed, as in fig. 26, the oscillations of that system would be induced in the vertical wire and then the desirable features of both methods would be combined. To further improve this a Tesla coil may be used by connecting the terminals of its secondary *S* to vertical and to ground, and inserting its primary *P* in the closed condenser circuit, as shown in fig. 27. It is understood that the turns of *S* are wound around *P*, just as the secondary of an induction coil is wound around its primary, and that the Tesla coil is a kind of transformer.

It is necessary to have the two circuits in tune; that is to say, the oscillations in the system vertical—*S*—ground must harmonize with oscillations in the closed condenser circuit *P–D–U–V*.

To tune these two systems a construction somewhat the same as that shown in fig. 28 is used by Signor Marconi. It was

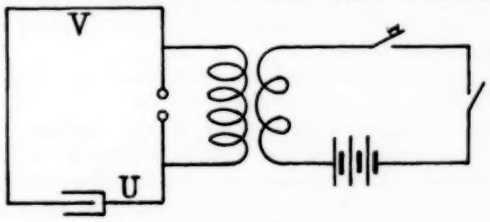


FIG. 25.

shown above that to alter the tune of an electrical circuit either the capacity or self-induction or both must be changed. To this end, a capacity *C* and a few turns of wire terminate the vertical wire. One terminal of the secondary of the Tesla coil may be moved up and down cutting in or out as many turns as is necessary to sufficiently alter self-induction; the capacity *C* is also made variable. The tune of the closed circuit may be changed by altering the variable capacity *D* of its circuit.

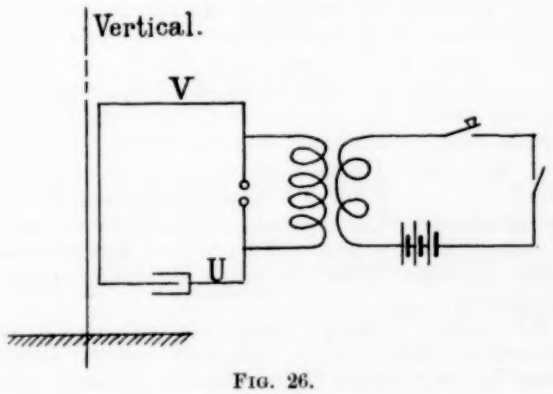


FIG. 26.

In fig. 29 the connections for the receiving apparatus are shown. The vertical *V* is terminated with a few turns of wire so that its induction may be changed. It is connected to one terminal of a transformer, *T* the other terminal of the primary *P* being grounded. The terminals of the secondary *SS* are connected to terminals of the coherer which has a variable capacity *D*, which is connected in parallel to the coherer. Any inductance or capacity may be added to the terminals *a* and *b* of the secondary coil. It is seen that a receiving system similar in construction to the sending system in fig. 27 is given. It is a good absorber, a persistent oscillator, and capable of having its tune altered at will.

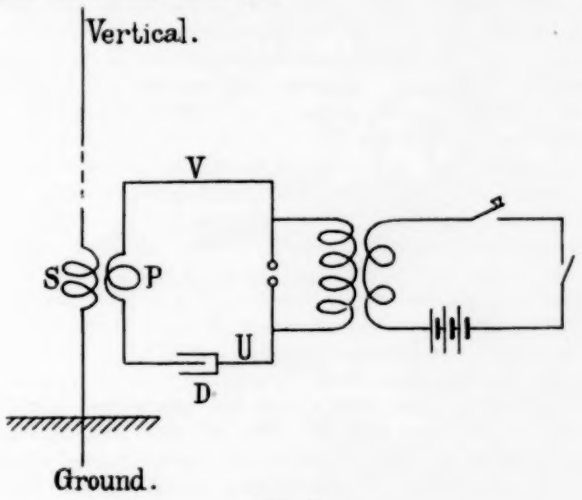


FIG. 27.

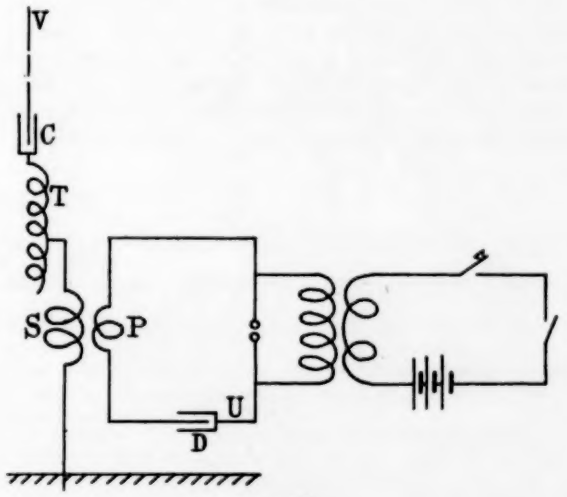


FIG. 28.

A duplex system may be arranged with the system just described by connecting differently tuned transmitters to verticals through different inductances at the sending station; and by connecting a suitably tuned receiver the same way to the receiving vertical. The connections for the transmitter are shown in fig. 30.

In general we may speak of two kinds of telegraphic systems; namely, tuned and untuned.

It is evident that with a perfectly tuned system of transmitters and receivers the number of stations may be multiplied and placed at will, connecting points far and near.

A system that is not arranged for tuning is called an open system, as in fig. 17, and with such an open system, the selection of stations can not be done arbitrarily. To illustrate: Suppose we wish to connect two points *A* and *B*, fig. 31. Set up instruments of the open system at each point; assume that the waves sent out after having traveled a distance *A B* are just

strong enough to work the receiving instruments. Now circumscribe both stations with circles having a radius equal to the distance *A B*. It may be seen that no other two independent stations can be worked within these two circles without

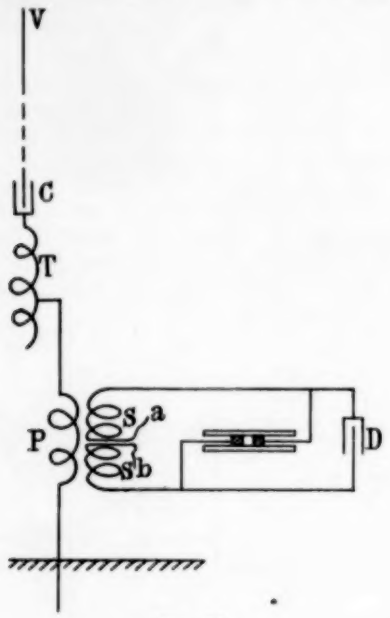


FIG. 29.

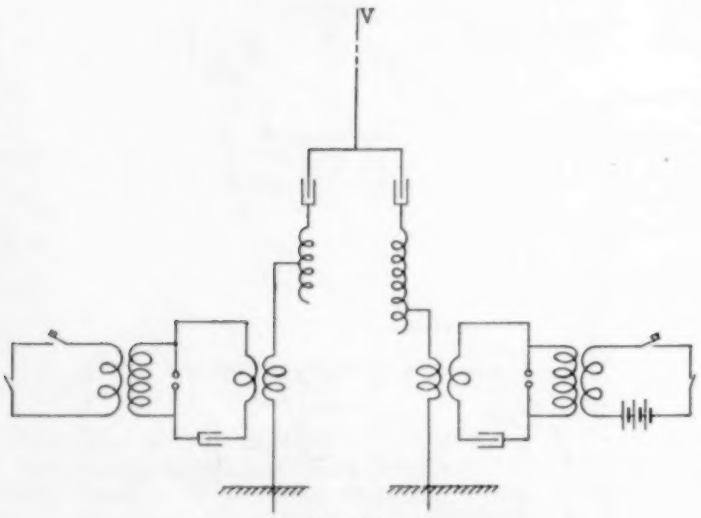


FIG. 30.

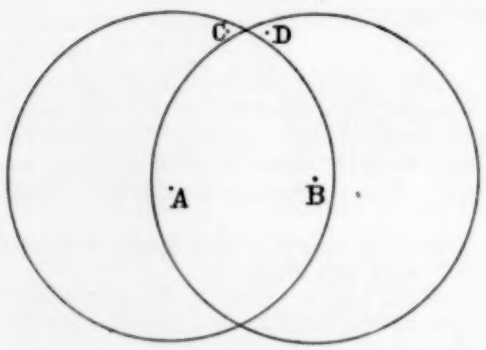


FIG. 31.

confusion unless they have receivers which can not be affected by the feeble waves from *A* and *B*. For example; two independent stations may be erected at *C* and *D* with less sensitive receivers and weaker transmitters than those at *A* and *B*. The waves sent out by the transmitters at *A* or *B* can not affect the less sensitive receiver at *C* and *D*, and the waves sent out by less powerful transmitters at *C* and *D* will affect receivers at these points, but on arrival at *A* and *B* they will be so weak that the receivers at these points will not be affected. Thus, stations properly placed, with instruments properly selected as to power and sensitiveness, may be worked "open" simultaneously and without confusion.

RADIOACTIVITY OF FRESHLY FALLEN SNOW.[1]

By S. J. ALLAN, M. Sc., dated McGill University, Montreal, January 27, 1903.

C. T. R. Wilson has shown that freshly fallen rain is radioactive, decaying with time. The author was led to believe that snow freshly fallen would also show this property. So during the first snowstorm a quantity of snow was gathered from a thin layer on the surface. This was then quickly evaporated down to dryness in a shallow tin vessel. This vessel which before filling with snow was tested and found to contain no trace of radioactivity, was now quite radioactive and was able to ionize the air in its immediate vicinity quite readily.

The apparatus used to test the presence of radioactivity consisted of two parallel zinc plates, insulated, a certain distance apart. The upper one was connected to one pair of quadrants of a sensitive electrometer, the other pair being earthed. This electrometer, when the needle was charged to 300 volts potential, gave about 500 divisions per volt, the distance between scale and mirror being about two meters. The lower plate was connected to one pole of a battery of accumulators, from which any voltage up to 300 could be taken. The other pole of the battery was earthed. The radioactive vessel was placed on this lower plate. There was always a slight ionization in the apparatus due to the natural ionization of air. As this only amounted to one-tenth of a division per second any increase could easily be detected. The ionization current as shown by the rate of movement of the electrometer gave a measure of the radioactivity present on the tin vessel. A standard specimen of uranium was kept as a means of standardizing the apparatus.

A great many tests were made extending over about six weeks and taking in four or five snowstorms. The snow was always collected from a thin sheet on the surface so as to get that which had recently fallen. It generally took from twenty to thirty minutes to evaporate down to dryness and test, so that the radioactivity had fallen a good deal in value during that time.

Two of the best methods of distinguishing between the various types of radioactive bodies were tried, viz, the rate of decay, and the penetrating power. Numerous tests made on the rate of decay showed that this radioactivity followed very closely a geometrical progression, falling to half value in about thirty minutes. The rate of decay was never found to decay though taken on different days and under different weather conditions. Three of these results are plotted in the accompanying curves, fig. 1. Curves *a* and *b* are results taken on the same day, *a* from one liter of snow and *b* from one-half liter. The fall of snow on this day was very heavy and damp. This was the greatest amount obtained on any day. Curve *c* shows a curve taken on another day, when there was a much smaller fall of snow, and is the amount from one liter. All of these curves show that the radioactivity falls to half value in about thirty-two minutes. Curve *d* shows the rate of decay of the radioactivity produced on a copper wire charged to a high negative potential in the open air. This is plotted on the same scale for sake of comparison. This falls to half value in about forty-eight minutes. The two rates of decay are thus distinctly different.

Tests were made on the penetrating power, and it was found

[1] Read before American Physical Society, January 3, 1903.

to be about the same as for that excited from air. Half of it was absorbed in two layers of aluminium foil 0.00038 centimeters thick.

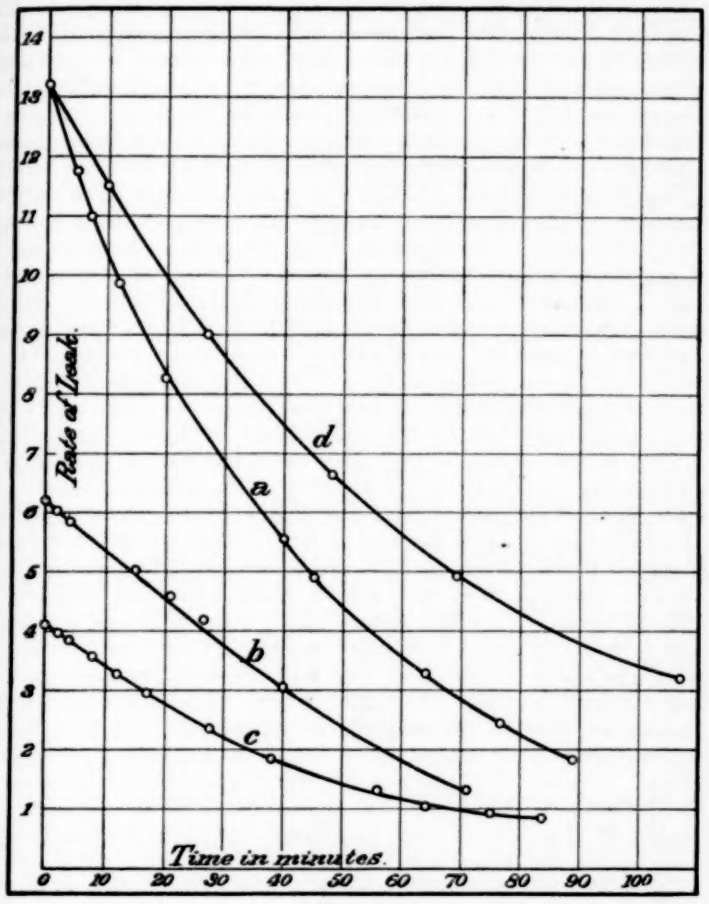


FIG. 1.

This radioactivity could be transferred by rubbing from the surface of the tin vessel on to leather or cotton, etc., moistened in ammonia. When the cotton thus treated was burnt to ashes the residue was still radioactive. Heating to a bright red heat destroyed only a very little of the radioactivity.

It was found that during a snowstorm the amount of radioactivity present kept quite constant so long as the fall of snow remained the same; twenty-four hours after the fall had ceased only a trace of radioactivity could be obtained. The amount of radioactivity obtained on the best day from a liter of snow was about equal in effect to one-fifth of a gram of uranium. It might be of interest to calculate the amount that could be obtained on such a day from one square mile of snow covered territory one centimeter thick. Taking 20 divisions per second as the amount obtained from a liter, we would get about 5×10^8 divisions per second. One scale division with this apparatus corresponds roughly to an ionization current of 3×10^{-13} amperes per second. Therefore a square mile ought to give something of the order of 1.5×10^{-4} amperes per second. This is an amount which could easily be measured by a galvanometer. Over the whole territory of Canada when it is snowing a considerable amount of energy is being radiated. From these results two conclusions may be drawn, either that this radioactivity is different from that excited from air, or that the excited air is a much more complicated substance than was at first supposed. There may be several processes going on, and this may be one of them. Each process may have different rates of formation and decay, and each radioactivity be the superposition of one or more of the processes. Recent experiments by the author rather support this latter view. These points are under investigation and will form the subject of a future paper. It seems beyond doubt that there is a radioactive substance in the atmosphere; how produced, at present, is not known. The falling snow acts as a sort of filter for it and tends to remove portions of it from the atmosphere.

This subject seems to me to be of great importance and interest, and future investigations along this line may greatly extend our knowledge of the physics of the atmosphere.

NOTES AND EXTRACTS.

METEOROLOGY AT THE AMERICAN ASSOCIATION.

At the meeting of the American Association for the Advancement of Science and its affiliated societies held at Washington, January 3–10, 1903, a number of papers were read which, judging from their titles, should have some bearing upon meteorological problems. We make the following selection of authors and titles and hope that in some cases we may be able to print the papers themselves:

S. P. Langley. The solar constant and related problems.

E. O. Lovett. Special periodic solution of n bodies. On the integrals of the problem of n bodies.

A. S. Mitchell. The new gases neon, krypton, and zenon in the chromosphere.

S. R. Cook. (Case School.) On the distribution of pressure around spheres moving with constant velocity in a viscous fluid.

H. W. Springsteen. (Case School.) On the thermal conductivity of glass.

A. L. Rotch. Atmospheric circulation near the equator.

Edwin H. Hall. (Harvard University.) Is there a southerly deviation of falling bodies?

J. R. Benton. (Washington, D. C.) Elasticity of copper and steel at — 186° C.

J. R. Benton. (Washington, D. C.) Experiments in connection with friction between solids and liquids.

J. S. Shearer. (Cornell University.) The heat of vaporization of oxygen and nitrogen.

E. Rutherford and H. L. Cook. (McGill University.) A penetrating radiation from the earth's surface.

S. J. Allen. (McGill University.) Radio-activity of freshly fallen snow.

Carl Barus. (Brown University.) The excessive nucleation of the atmosphere.

Carl Barus. (Brown University.) Certain data bearing on the occurrence of lightning.

Carl Barus. (Brown University.) The electrical charges of water nuclei.

A. F. Zahm. Theory, construction, and use of a pressure tube anemometer.

H. Parker Willis. (Washington, D. C.) Requisites in crop reporting.

Prof. Willis L. Moore. Economic work of the Department of Agriculture, especially of the Weather Bureau.

Edwin G. Dexter. The psychology of weather influence.

A. H. Pierce. The apparent form of the heavens and the illusory enlargement of heavenly bodies at the horizon.

T. C. Chamberlin, William H. Welch, and others. How can endowments be used most effectually for scientific research?

Stanley Coulter. (Purdue University.) The changes of fifty years in a local flora.

C. Abbe. Observations on the cause of the rollers and double rollers at the island of Ascension.

E. F. Nichols and G. F. Hull. The pressure due to radiation.

R. W. Wood. Screens transparent only to ultraviolet light.

L. R. Jones and A. W. Edson. Pressure and flow of sap in the sugar maple.

H. C. Cowles. The relative importance of edaphic and climatic factors in determining the vegetation of mountains with especial reference to Mount Katahdin.

D. T. MacDougall. Plant growth as effected by light and darkness.

Peter Fireman. (Washington, D. C.) Motion of translation of a gas in a vacuum.

THE BECQUEREL RAYS IN METEOROLOGY.

In Harper's Monthly Magazine for January, 1903, Prof. J. J. Thomson has a short and suggestive article on the Becquerel rays, in continuation of his preceding article on Cathode rays

in Harper's for September, 1901. These articles are easily accessible to American readers, but we summarize them in connection with Thomson's extended memoir, pp. 25–73, of Vol. IV of the New Volumes, or 10th edition, of the Encyclopedia Britannica, published in October, 1902. The eminent author brings out very clearly the fact that many substances have the power of radiating other kinds of rays than those that cause the phenomena of light and heat. It was long known that just as some bodies by being heated sufficiently give out light and are said to be red hot or white hot, so other bodies when illuminated sufficiently by the sun's rays, or by an electric light, give out the light that is known as phosphorescence. Thus uranium salts when exposed to sunlight for a short time and then removed into a dark room will continue to glow with a pale light for a long time. This was styled phosphorescence because the glow has very much the appearance of the light given out by phosphorus in the air; but the glow of phosphorus is due to the slow oxidation of that substance, whereas the glow of uranium salts appear to be a purely mechanical process like the long-continued ring of a bell after it has been struck. The phosphorescence from uranium has a feeble photographic power, but it continues for a long time and by long exposure will produce excellent pictures. It was formerly supposed that a previous exposure to sunlight is essential in order to produce the phosphorescnce of uranium, but Becquerel was able to show that salts of uranium crystallized in the dark and never exposed to any bright light emitted the same radiation, as though this power were a property inherent to uranium itself.

These Becquerel rays from uranium are, in fact, a mixture of Roentgen rays and cathode rays. The former which Professor Rutherford called the alpha rays, were found by him to be easily stopped by thin layers of paper or aluminum, while the cathode or beta rays can penetrate aluminum, so that when they have once been generated inside of a vacuum by electric discharge, they can pass through an aluminum window into the air outside; they are also deflected by the action of a magnet, as shown by Becquerel. The cathode rays of the electric discharge have been investigated by Prof. J. J. Thomson, who showed that they consist of exceedingly small particles, much smaller than an ordinary molecule or chemical atom, charged with negative electricity and moving at the rate of many thousand miles per second; their velocity depends upon the perfection of the vacuum in which the electric discharge takes place. The highest recorded velocity of the cathode rays from the electric discharge in a vacuum is about 70,000 miles per second, but the cathode rays given out by uranium spontaneously have a still greater velocity.

Another substance having the same peculiar power of emission is thorium, which phosphoresces so perfectly that it can be used in the manufacture of the incandescent mantels of the Welsbach and other lights. Any natural mineral containing even a small percentage of uranium was found by Monsieur and Madame Curie to possess the power of phosphorescence and some minerals seem to have it in a remarkable degree, as though some powerful radiator were present. Finally, these investigators were able to extract from pitch blende a very remarkable substance, namely, polonium, which was associated with bismuth. Subsequently M. Bement extracted radium, which was associated with barium, and finally Debierne obtained a third substance which he called actinium.

We have, therefore, radiations from the ordinary minerals, uranium, thorium, and pitch blende and also from the special substances radium, polonium, and actinium extracted from pitch blende. Radium has become famous through the great perseverance and skill of Monsieur Curie and Madame Curie, his wife, in purifying it and investigating its properties. In its purest condition it exceeds uranium an hundred thousand fold in its radioactivity. The velocities of the rays emitted by it have been recorded as 120,000 miles per second instead of the 70,000 attributed to uranium; the total loss of mass is exceedingly small, the loss of energy in one year is only large enough to melt a layer of ice of the same area as the radium and 0.02 of an inch thick. The radium is self luminous, shining with a bluish light; it, like the Roentgen rays, makes a sensitive screen phosphoresce; it shows the bones in the hand, and is so vigorous that it has produced sores on those who have incautiously carried it about their persons. The radium emits negatively electrified particles with a velocity in some cases approaching that of light. This continued emission of particles from the radium, of course implies that the radium is losing mass and energy. As this loss of energy goes on continuously the questions arise what is its nature? And how is it stored away? Becquerel was able to transfer the radioactivity from uranium to barium. Rutherford, of McGill University, separated two substances from thorium, one an inert body and the other very active, which after a few days had entirely interchanged their properties, the active becoming inert and vice versa; the time taken by the active body in losing one-half of its activity was equal to the time required by the inert body in regaining one-half of its activity. There is, therefore, an active form of thorium and an inactive form. It is possible that there may be also analogous active and inactive forms of radium. The active form of thorium not only gives out Roentgen and cathode rays, but also a radioactive gas whose activity lasts only for a few minutes and when this gas becomes inert it resembles the new gases argon and helium. Radium also gives out a radioactive gas and its activity lasts much longer than that from thorium. These radioactive gases, or emanations, possess the remarkable property of making almost any substance with which they come in contact also radioactive. A piece of paper can be made as strongly active as a piece of metal. The induced radioactivity is very much increased if the substance is negatively electrified while being acted on by the emanation.

Elster and Geitel have shown that substances may be made radioactive without the aid of the emanations from thorium or radium; it is only necessary to hang them up in the open air, insulate them, and charge them strongly with negative electricity. As the earth itself is negatively electrified, it follows that all pointed conductors connected with the earth and discharging negative electricity into the air become radioactive. Thus, lightning conductors, the pointed leaves and spines of trees, and even freshly fallen rain or snow are always radioactive. The process by which they attain this property is explained by Prof. J. J. Thomson as due to the fact that positively electrified ions accumulate close to the surface of the body, forming a layer of positive electricity around it. This pulls the negative electricity from the interior of the body so that it shoots out with great velocity. But negative electricity moving with great velocity is the same thing as cathode rays, and if a body gives out cathode rays it is radioactive. Thus, it happens that cathode rays are probably emanating from all points of the earth's surface.

This last conclusion stands in intimate relation to numerous phenomena of meteorology and agriculture. The electrical discharges from hilltops and mountains are often exceedingly severe. The observers of the United States Coast and Geodetic Survey and of the Weather Bureau have sometimes been frightened from their mountain stations by the brilliant, and apparently dangerous, long-continued discharges of negative electricity. The rapidity with which rainfall evaporates from mountain peaks has often been attributed, in a general way, to the electrification of the mountain mass. The difficulty in raising plants, the stunted tree growth, and the absence of forests have been attributed to some such problematic electric influence. It is quite plausible that the frequency and severity of the electrical phenomena of thunderstorms in mountainous

regions may be partly due to the intense discharge of negatively electrified particles into the atmosphere from the highly electrified mountain mass, while of course the rapid currents of rising and falling air are thermodynamic effects.

Other properties of the radiations from radiant matter are fully given by Prof. J. J. Thomson in his article in the Encyclopedia Britannica on the electric discharge through gases.

> Gases become conductors of electricity when they are exposed to the Roentgen rays or to the radiation from uranium, thorium, polonium, radium, or actinium, or by the passage through them of cathode rays or Lenard rays, or by exposure to the radiation emitted by electric sparks. * * * A gas exposed to Roentgen rays retains its conductivity for some little time. If, however, it is filtered through a plug of tightly packed glass, wool, or through water, or through metal tubes, or if an electric current be made to traverse it, its conducting power is removed. * * * We regard the conductivity of the gas as due to the presence of positively and negatively electrified particles called ions. * * * An ion after being formed does not last forever, but has a certain duration of life. * * *

The life of an ion in a gas at low pressure is longer than at high pressure, but the velocity of the ion is greater at low pressure. The velocity of the negative ion is almost always larger than that of the positive ion; but if moisture be present in the gas it tends to collect around the ion; it condenses more easily on the negative than on the positive ion, and produces a relatively larger diminution in the velocity of the negative than the positive. When Roentgen rays are passed through moist but dustless air while the air is being expanded, a small expansion and cooling will produce cloudy condensation, but a much larger expansion and cooling will be needed in order to produce cloudy condensation without the assistance of the ions produced by the Roentgen rays. The latter seem, therefore, to act as nuclei favoring the condensation of the vapor.

The sun as the source of our light and heat sends us an intense and complex radiation which doubtless includes the Roentgen and other forms of rays. Sunlight as we get it at the earth's surface is possibly not so rich in these rays as it is at the upper limit of the atmosphere and it does not produce electric conductivity in gases so perfectly as does the radiation from the electric arc light. Elaborate series of observations have rendered it probable that ultraviolet light does not ionize the gas through which it passes until after it has struck the absorbing surfaces between which the electric discharge is taking place, whereas in the case of the cathode and the Lenard rays the gas is ionized at once by the passage through it of the negatively electrified particles moving with great velocity.

It is a plausible hypothesis that sunlight after striking the negatively electrified surface of the earth is reflected and changed in some such manner that the radiation outward from the earth's surface has the power to ionize some of the constituents of the atmosphere and stimulate the condensation of vapor into fog and cloud. Meteorologists therefore must look forward with much interest to further investigations in this field of research.

WEATHER BUREAU MEN AS INSTRUCTORS.

Mr. Ford A. Carpenter, Observer, reports that on December 10, he delivered a lecture on Weather Studies without Instruments before the senior class of the San Diego State Normal School; special reference was made to the clouds and their relation to weather changes.

H. H. MOORE.

Harry H. Moore, voluntary observer for a number of years past, was born in New Haven, Conn., January 15, 1872. At an early age he evinced a mental activity far in excess of his physical strength—a condition remaining with him through life.

Unable to enter into any active business pursuit, he turned to books, music, and nature for recreation, being an extensive reader, a fine pianist and a genuine lover of natural scenery; his love of nature led him into the habit of observing the varying phases of the weather.

The most marked characteristics of his nature were truth and accuracy, subordinating everything, often personal inconvenience, to attain these; this is shown by the careful manner in which his weather reports were prepared, and the punctilious care which characterized all his dealings.

To the casual observer he was quiet and reserved; to those who knew him intimately, a young man of the highest ideals, an exponent of the worthiest sentiments found in humanity, a trusted and loyal friend, whose death occurring in Hartford, Conn., December 8, 1902, leaves no stain, no blemish—only a pure, sweet memory.—*K. G. T.*

CORRIGENDA.

MONTHLY WEATHER REVIEW for July, 1902, page 357, column 1, lines 21 and 22 from bottom, for "several ascensions" read "first ascension;" line 19 from bottom, for "same" read "next."

MONTHLY WEATHER REVIEW for November, 1902, page 525, column 1, line 25, for "1852" read "1872."

THE WEATHER OF THE MONTH.

By W. B. STOCKMAN, Forecast Official, in charge of Division of Records and Meteorological Data.

CHARACTERISTICS OF THE WEATHER FOR DECEMBER.

The mean temperature for the month was generally below the normal, and in appreciable values in the different geographical districts, except in the South Atlantic States, Florida Peninsula, the middle Plateau, and middle and south Pacific districts, where the mean daily departures were slightly in excess.

In the west Gulf States, upper Lake region, North Dakota, middle and southern slope, southern and middle Plateau, and middle and southern Pacific districts there was a slight deficiency in precipitation, the greatest departures — 1.5 inches and — 1.0 inch, occurring, respectively, in the two last-named districts. In the remaining geographical districts the precipitation was above the normal, but the departures were slight, except in New England, the Middle Atlantic States, Ohio Valley and Tennessee, Missouri Valley, and the north Pacific districts, where they ranged from + 1.1 inches to + 2.3 inches.

The relative humidity was normal in the east Gulf States, North Dakota, and the north Pacific districts; slightly below in the South Atlantic States, Florida Peninsula, and the middle and south Pacific districts; elsewhere it was above normal, and markedly so in the northern slope and middle slope regions, where it amounted to + 13 per cent and + 10 per cent, respectively.

The cloudiness was below the average in the Florida Peninsula, North Dakota, and the middle Plateau region; normal in the south Pacific district, and above normal in the remaining geographical districts.

PRESSURE.

The distribution of monthly mean pressure is shown graphically on Chart VI and the numerical values are given in Tables I and VI.

The area of highest mean barometric pressure overlay the Middle Atlantic and Southern States, central valleys, and cen-

tral Rocky Mountain regions. The lowest mean pressure was reported from the extreme northwestern part of the north Pacific coast district. The pressure was above the normal in New England and in those portions of the Middle States contiguous thereto, upper Lake region, upper Mississippi Valley, Missouri Valley, the middle and northern slope, and the eastern part of the southern and middle Plateau regions generally, and in the lower Ohio Valley and western Tennessee; elsewhere it was generally below the normal, but in no district was the departure especially marked.

In New England the mean pressure for the month diminished slightly from that of November, 1902, and increased in all other districts, and from about longitude 90° westward to the Pacific coast districts with a marked variation, the maximum increase, about .20 inch, occurring over North Dakota.

TEMPERATURE OF THE AIR.

In the eastern part of the South Atlantic States and Florida, New Mexico, northwestern Colorado, southern and western Wyoming, southern Idaho, Nevada, central and southern Oregon, and California, except the central coast and central-northern valley districts, reports from regular Weather Bureau stations show the mean temperature to have been above the normal. In the remaining districts the mean temperature was below the normal, and generally to a marked degree; the mean daily departures from the southern parts of Missouri and Kansas northwestward over North Dakota and Montana ranged from —4° to —11°. In central and western New England and the north-central portions of the Middle Atlantic States the departures ranged from —4.0° to —5.8°.

Reports from climate and crop centers, in which are included reports from voluntary and cooperating stations with the regular stations in compiling the data, show a much less extensive area in which mean temperatures above normal obtained.

The location of the region of greatest negative departure from the normal, as deduced from reports from climate and crop centers, is about the same as from regular stations only, but the departures were, as a rule, somewhat smaller in value, especially over portions of the middle-western and northwestern area.

The average temperature for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	26.5	—3.5	+ 4.5	+0.4
Middle Atlantic	12	34.2	—2.0	+ 1.9	+0.2
South Atlantic	10	49.0	+0.2	+ 1.0	+0.1
Florida Peninsula*	8	62.4	+1.3	+ 4.6	+0.4
East Gulf	9	49.5	—1.7	+ 4.5	+0.4
West Gulf	7	49.6	—1.8	+10.0	+0.8
Ohio Valley and Tennessee	11	35.7	—2.5	+ 0.7	+0.1
Lower Lake	8	27.5	—3.0	+ 3.6	+0.3
Upper Lake	10	23.4	—1.1	+18.1	+1.5
North Dakota*	8	7.4	—5.4	+12.4	+1.0
Upper Mississippi Valley	11	25.0	—3.4	+ 7.3	+0.6
Missouri Valley	11	22.1	—6.5	+ 5.2	+0.4
Northern Slope	7	20.6	—3.9	+ 9.7	+0.8
Middle Slope	6	30.8	—4.0	+ 9.0	+0.8
Southern Slope*	6	40.2	—1.6	+12.6	+1.0
Southern Plateau*	13	38.7	—0.4	— 1.5	—0.1
Middle Plateau*	9	28.0	+1.0	+ 1.9	+0.2
Northern Plateau*	12	30.0	—0.3	+ 5.1	+0.4
North Pacific	7	41.8	—0.3	+ 3.8	+0.3
Middle Pacific	5	48.7	+0.2	— 0.2	0.0
South Pacific	4	52.8	+0.1	— 5.7	—0.5

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Prof. R. F. Stupart says:

The temperature was below the average in all portions of the Dominion. The most marked negative departures occurred in the Northwest Territories and over the eastern and northern parts of British Columbia, and varied from 6° to 10°, and the next largest departures were over the greater portion of Ontario and in western Quebec and the western part of New Brunswick, and ranged from 3° to 5°.

The location of the isotherms of mean temperature lie somewhat to the southward of their positions in December, 1901, except along the coasts of the South Atlantic and Gulf States, and over Florida. Over the extreme southern portion of Florida mean temperatures of 70° were reported, of which there were none in December, 1901. Over the extreme northwestern portion of Minnesota and northern North Dakota mean temperatures of 5° or less were reported, which is about 5° lower than the mean temperatures reported from that region in December, 1901.

As a rule the isotherms of maximum and minimum temperatures were located to the southward of their position in December, 1901. Freezing temperatures extended well into the southern part of the central section of Florida, and in central Texas to well below the thirtieth parallel. Light frosts occurred in California during the first week, and heavy frosts in all sections during the second and third weeks, and in some districts during the fourth week.

PRECIPITATION.

The departures from the normal, as deduced from the data compiled at climate and crop centers, show the precipitation to have been in excess everywhere, except in south-central Texas and California. The region of greatest excess extended from Arkansas and Mississippi northeastward, the maximum positive departures being reported from Kentucky, 3.80 inches, and New Jersey, 3.84 inches. This distribution of precipitation differs somewhat from that charted from data collected at the regular stations, which show several areas over which the precipitation was deficient. This variance is, undoubtedly, due to the shorter period of time for which means have been computed from the voluntary and cooperating stations and to the greater number of stations distributed over the several districts.

The region of greatest monthly precipitation was located on the north Pacific coast, with a second area in southeastern Arkansas, western Tennessee, and southern and central Kentucky. In the latter region the amounts were not so great as in the former.

Idaho reports the amount of precipitation during the month as the greatest during any December of record. The precipitation was heaviest over the northeastern and central districts, and the larger amounts reported from those districts materially affected the average for the State, as over the other portions the precipitation generally was slightly below the normal.

The snowfall over eastern Ohio, eastern West Virginia, Pennsylvania, New York, and New England was very heavy, as it also was in portions of the following States: Michigan, Wisconsin, Iowa, and Minnesota, and the Rocky Mountain regions generally. The consensus of opinion is that an ample amount of snow has already fallen in the Rocky Mountain districts to furnish a sufficient supply of water for irrigation and other purposes during the coming season.

Colorado reports 41 stations with 10 inches or more, and Ruby, 79 inches of snowfall during the month; several stations in northeastern upper Michigan report 40 or more inches; 6 to 16 inches fell in northwestern Arkansas on the 4th.

The southern limit of snow on the ground at the end of the month was at about latitude 40° on the Atlantic coast, trending slightly to the southward in passing westward to about latitude 36° in New Mexico, then bending somewhat to the northward until northeastern California was reached; thence the western limit was about longitude 120° until northern

Oregon was reached, when it advanced to about longitude 122°, and passed northward over Washington.

HAIL.

The following are the dates on which hail fell in the respective States:

Arizona, 18. Arkansas, 12, 14. California, 4, 9, 10, 11, 12, 22, 26. Connecticut, 5, 13, 21, 25. Delaware, 15. District of Columbia, 4, 29. Florida, 4. Georgia, 4. Idaho, 1. Illinois, 14, 15, 20. Indiana, 5, 13, 21. Indian Territory, 14. Kentucky, 8. Louisiana, 4. Maryland, 4, 5, 13, 15, 16, 28, 29. Massachusetts, 3, 5, 16, 21, 30. Michigan, 11. Missouri, 20. Nevada, 10, 11. New York, 3, 13, 14, 15, 21. North Carolina, 15, 29. North Dakota, 21. Ohio, 12, 21. Oklahoma, 14. Oregon, 1, 4, 5, 10, 11, 12, 21, 22, 26, 27. Pennsylvania, 2, 11, 12, 13, 15, 16, 21. Rhode Island, 13, 21. Utah, 2, 5, 12, 15, 27. Vermont, 21, 23. Virginia, 4, 13, 15, 26, 29. Washington, 1, 2, 4, 5, 22, 23, 26, 31. West Virginia, 1, 15, 29. Wisconsin, 15.

SLEET.

The following are the dates on which sleet fell in the respective States:

Alabama, 28, 29. Arizona, 14, 19, 31. Arkansas, 3, 4, 14, 28, 29. California, 10, 11, 26. Colorado, 2, 8, 13, 19. Connecticut, 5, 13, 21, 25, 29, 30. Delaware, 5, 12, 13. District of Columbia, 29. Georgia, 15, 28, 29. Idaho, 8, 9, 25, 26. Illinois, 2, 3, 4, 10, 11, 12, 13, 14, 15, 18, 19, 21, 23, 24, 28, 29. Indiana, 2, 5, 6, 11, 12, 13, 14, 15, 16, 24. Indian Territory, 3, 7, 13, 14, 28. Iowa, 2, 3, 6, 11, 12, 14, 15, 19, 20. Kansas, 1, 2, 3, 6, 8, 10, 11, 12, 13, 14, 15, 19, 20, 28. Kentucky, 4, 5, 13, 14, 15, 28, 29. Louisiana, 4, 30. Maine, 3, 6, 21. Maryland, 1, 4, 5, 12, 13, 14, 15, 16, 17, 28, 29, 30. Massachusetts, 5, 16, 21, 23, 30. Michigan, 2, 3, 10, 11, 14, 15, 16, 18, 20, 21. Minnesota, 19, 20. Mississippi, 4, 28. Missouri, 2, 3, 4, 5, 6, 10, 11, 12, 13, 14, 15, 16, 20, 23, 27, 28. Montana, 8. Nebraska, 12, 15, 19, 20, 26. Nevada, 11. New Hampshire, 3, 16, 20, 21, 29. New Jersey, 1, 4, 5, 11, 12, 13, 14, 15, 16, 25, 29, 30. New Mexico, 13, 15, 31. New York, 5, 10, 11, 13, 14, 15, 16, 21, 22. North Carolina, 4, 14, 15, 29. North Dakota, 20, 21, 24. Ohio, 2, 10, 11, 12, 13, 14, 15, 27. Oklahoma, 7, 11, 13, 14, 28. Oregon, 2, 3, 5, 7, 10, 11, 22, 23, 24, 26. Pennsylvania, 1, 5, 11, 12, 13, 14, 15, 16, 21, 25, 29. South Carolina, 4, 15, 29. South Dakota, 14, 15, 19, 20, 21. Tennessee, 14, 15, 28, 29. Texas, 12, 13, 14, 15, 30, 31. Utah, 1, 4, 5, 6, 11, 12, 23, 27, 28. Vermont, 21, 23. Virginia, 4, 5, 12, 13, 14, 15, 16, 17, 25, 29, 30. Washington, 1, 3, 5, 8, 9, 20, 22, 24, 25. West Virginia, 5, 7, 13, 14, 15, 16, 17, 28, 29. Wisconsin, 1, 2, 15, 16, 19, 20, 21. Wyoming, 7, 11, 12, 13, 20.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	5.77	162	+2.2	— 2.1
Middle Atlantic	12	4.86	149	+1.6	+ 0.2
South Atlantic	10	3.67	106	+0.2	—10.2
Florida Peninsula*	8	2.79	112	+0.3	+ 1.6
East Gulf	9	5.28	115	+0.7	— 9.3
West Gulf	7	2.82	85	—0.5	— 5.6
Ohio Valley and Tennessee	11	4.99	143	+1.5	— 6.5
Lower Lake	8	3.10	107	+0.2	— 1.0
Upper Lake	10	2.02	95	—0.1	— 2.9
North Dakota*	8	0.47	82	—0.1	+ 0.7
Upper Mississippi Valley	11	2.72	135	+0.7	+ 2.3
Missouri Valley	11	2.16	204	+1.1	+ 2.2
Northern Slope	7	0.73	138	+0.2	+ 0.3
Middle Slope	6	0.75	79	—0.2	+ 3.7
Southern Slope*	6	1.15	85	—0.2	+ 4.8
Southern Plateau*	13	1.02	84	—0.2	— 1.0
Middle Plateau*	8	1.00	77	—0.3	— 2.3
Northern Plateau*	12	2.09	111	+0.2	— 0.8
North Pacific	7	11.09	126	+2.3	+ 5.8
Middle Pacific	5	3.89	72	—1.5	+ 1.6
South Pacific	4	2.02	67	—1.0	— 0.9

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Professor Stupart says:

The precipitation was considerably above the average over the greater portion of the Maritime Provinces, the excess at Sydney amounting to 3.8 inches. In Quebec there was a small deficiency in the western part, while elsewhere in the Province the precipitation was average or a little above. In Ontario, except in a few isolated localities, the average was not maintained, but the minus departures were only locally large. In Manitoba and the Territories the precipitation exceeded the average quantity in some localities and in others it did not attain to it. Winnipeg and Calgary were respectively half an inch below the normal quantity and Medicine Hat and Edmonton half an inch above. In British Columbia, Victoria and Barkerville were 1.4 inches and 1.7 inches, respectively, below the usual amount, while other stations from which returns have been received exceeded the average precipitation. At the close of the month snow to a depth of 20 inches lay on the ground in Cariboo in British Columbia. The Territories and Manitoba were well covered, especially Saskatchewan, where the depth was 12 inches and over. In northern Ontario and over Quebec the depth was from 14 to 24 inches. In the Peninsula of Ontario there was very little, not enough for sleighing in many localities. In the Maritime Provinces the heavy snowfall of the first half of the month had pretty well disappeared and the ground was bare, except in parts of New Brunswick.

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Bismarck, N. Dak	23	52	nw.	North Head, Wash	8	70	s.
Block Island, R. I	5	73	ne.	Do	12	60	s.
Do	8	60	nw.	Do	15	55	se.
Do	13	63	ne.	Do	19	60	se.
Do	14	58	n.	Do	22	66	se.
Buffalo, N. Y	3	65	w.	Do	24	71	se.
Do	10	58	w.	Do	25	72	se.
Do	17	55	w.	Do	26	60	s.
Do	22	52	w.	Do	29	62	se.
Do	30	50	w.	Do	30	60	se.
Cheyenne, Wyo	27	52	w.	Do	31	60	se.
Chicago, Ill	2	58	ne.	Philadelphia, Pa	5	52	n.
Do	12	54	ne.	Point Reyes Light, Cal	1	50	nw.
Do	20	51	se.	Do	9	53	s.
Cleveland, Ohio	8	50	w.	Do	13	58	nw.
Duluth, Minn	24	56	nw.	Sioux City, Iowa	24	50	nw.
Do	25	50	nw.	Syracuse, N. Y	16	58	s.
Eastport, Me	26	54	e.	Tatoosh Island, Wash	1	54	w.
Evansville, Ind	2	54	sw.	Do	3	62	s.
Hatteras, N. C	5	60	sw.	Do	10	62	e.
Huron, S. D	27	51	se.	Do	12	54	e.
Memphis, Tenn	2	52	sw.	Do	19	51	s.
Mount Tamalpais, Cal	9	56	sw.	Do	22	57	s.
Do	27	52	nw.	Do	23	64	e.
Nantucket, Mass	5	62	n.	Do	24	64	e.
Do	13	50	ne.	Do	25	76	sw.
New York, N. Y	5	56	n.	Do	28	54	sw.
Do	8	50	nw.	Do	29	62	sw.
Norfolk, Va	5	52	sw.	Do	30	64	sw.
North Head, Wash	1	55	nw.	Winnemucca, Nev	4	52	w.
Do	3	74	se.				

HUMIDITY.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	77	+ 2	Missouri Valley	82	+ 7
Middle Atlantic	77	+ 3	Northern Slope	80	+13
South Atlantic	78	— 1	Middle Slope	75	+10
Florida Peninsula	79	— 3	Southern Slope	72	+ 5
East Gulf	78	0	Southern Plateau	52	+ 4
West Gulf	77	+ 4	Middle Plateau	68	+ 1
Ohio Valley and Tennessee	79	+ 4	Northern Plateau	82	+ 1
Lower Lake	82	+ 4	North Pacific	88	0
Upper Lake	82	+ 1	Middle Pacific	82	— 2
North Dakota	79	0	South Pacific	72	— 2
Upper Mississippi Valley	82	+ 6			

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the table below:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.9	+ 0.1	Missouri Valley	6.4	+ 1.3
Middle Atlantic	6.2	+ 0.8	Northern Slope	5.6	+ 1.0
South Atlantic	5.2	+ 0.5	Middle Slope	5.0	+ 1.0
Florida Peninsula	3.7	— 0.9	Southern Slope	4.6	+ 0.2
East Gulf	5.8	+ 0.6	Southern Plateau	3.5	+ 0.5
West Gulf	5.7	+ 0.4	Middle Plateau	4.8	— 0.3
Ohio Valley and Tennessee	7.5	+ 1.4	Northern Plateau	7.6	+ 0.5
Lower Lake	8.1	+ 0.5	North Pacific	8.4	+ 1.1
Upper Lake	7.7	+ 0.6	Middle Pacific	5.8	+ 0.4
North Dakota	4.8	— 0.4	South Pacific	4.4	0.0
Upper Mississippi Valley	6.8	+ 1.1			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 386 thunderstorms were received during the current month as against 336 in 1901 and 481 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 15th, 61; 12th, 58; 20th, 37.

Reports were most numerous from: Louisiana, 45; Missouri, 39; Arkansas, 31.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 10th to 18th.

In Canada: No thunderstorms were reported. An aurora was observed at Minnedosa on the 23d.

DESCRIPTION OF TABLES AND CHARTS.

By W. B. STOCKMAN, Forecast Official, in charge of Divison of Records and Meteorological Data.

Table I gives, for about 145 Weather Bureau stations making two observations daily and for about 25 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station, the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . . .).

Table III gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table IV gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table V gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates per hour (ins.)	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table VI gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table VII gives the heights of rivers referred to zeros of gages; it is prepared by the Forecast Division.

NOTES EXPLANATORY OF THE CHARTS.

Chart I, tracks of centers of high areas, and Chart II, tracks of centers of low areas, are constructed in the same way. The roman numerals show number and chronological order of highs (Chart I) and lows (Chart II). The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the observations at 8 a. m. and 8 p. m., seventy-fifth meridian time. Within each circle is also given (Chart I) the highest barometric reading and (Chart II) the lowest barometric reading at or near the center at that time, and in both cases as reduced to sea level and standard gravity.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all by 0.0.

Chart IV.—Sea-level pressure and resultant surface winds. The pressures have been reduced to sea level and standard gravity by the method fully described by Prof. Frank H. Bigelow on pages 13–16 of the REVIEW for January, 1902. The pressures have also been further reduced to the mean of the twenty-four hours by the application of a suitable correction, to the mean of the 8 a. m. and 8 p. m. readings, at stations taking two observations daily, and to the 8 a. m. or 8 p. m. observation, respectively, at stations taking but a single observation. The diurnal corrections so applied will be found in Table 27, Volume II, Annual Report of the Chief of Weather Bureau, 1900–1901, pp. 140–164.

The isotherms on the sea-level plane have been constructed by means of the data summarized in chapter 8 of Professor Bigelow's Report on the Barometry of the United States and Canada, which can be found in the Annual Report of the Chief

of the Weather Bureau for 1900–1901, Volume II. The correction $t_0 - t$, temperature on the sea-level plane minus the station temperature, by Table 48 of the Barometry Report, is added to the observed surface temperature to obtain the adopted sea-level temperature. On account of excessive local abnormalities of temperature in the great California Valley, between the Coast Range and the Sierra Nevada Mountains, the stations in that valley have been ignored in drawing the lines of equal temperature.

The wind directions are the computed resultants of observations at 8 a. m. and 8 p. m. daily. The resultant duration is shown by figures attached to each arrow.

Chart V.—Hydrographs for seven principal rivers of the United States, prepared by the Forecast Division.

Chart VI.—Surface temperatures; maximum, minimum, and mean of these. Lines of equal monthly mean temperature in red; lines of equal maximum temperature in black; and lines of equal minimum temperature (dotted) also in black.

Chart VII.—Percentage of sunshine. The average cloudiness at each Weather Bureau station is determined by numerous personal observations during the day. The difference between the observed cloudiness and 100, it is assumed, represents the percentage of sunshine, and the values thus obtained have been used in preparing Chart VII.

Chart VIII.—West Indian monthly isobars, isotherms, and resultant winds, constructed as on Charts IV and VI.

Chart IX.—The total snowfall. This is based on the reports from regular and voluntary observers, and shows the depth of the snowfall during the month in inches. In general, the depth is shown by lines inclosing areas of equal snowfall, but in special cases figures are also given.

Chart X.—Snow on ground at end of month.

TABLE 1.—*Climatological data for Weather Bureau Stations, December, 1902.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				
New England.							**36.5**	**— 3.5**									**77**	**5.77**	**+ 2.2**								**5.9**	
Eastport	76	69	74	29.92	30.01	+ .03	22.4	— 3.1	52	22	30	—15	9	14	40	21	17	82	5.77	+ 1.8	18	11,281	nw.	54	e.	26	10	6	15	5.9	24.3
Portland, Me.	103	81	117	29.91	30.05	+ .02	23.4	— 4.0	51	22	31	—14	9	16	38	20	15	74	6.54	+ 3.0	18	8,255	nw.	40	se.	22	11	9	11	5.5	23.8
Concord	298	70	79	29.72	30.06	.00	22.0	.....	48	22	31	—12	9	13	45	....	....	....	5.87	+ 2.6	18	4,456	nw.	28	nw.	8	12	9	10	5.4	26.6
Northfield	876	16	60	29.08	30.08	+ .03	15.6	— 5.8	44	22	26	—19	9	5	54	14	10	79	3.45	+ 0.7	17	5,940	s.	40	nw.	8	8	3	20	7.1	19.5
Boston	125	115	181	29.92	30.07	+ .02	28.6	— 2.5	58	22	37	— 8	9	20	37	26	22	79	4.48	+ 1.0	16	9,258	w.	38	sw.	22	13	5	13	5.6	22.8
Nantucket	12	43	85	30.03	30.04	— .01	33.6	— 2.8	51	22	39	— 1	9	28	36	32	28	79	5.90	+ 1.7	18	13,507	w.	62	n.	5	3	8	20	7.3	20.1
Block Island	31	11	60	30.02	30.05	— .01	33.3	— 2.9	54	22	40	— 1	9	27	29	31	27	76	7.64	+ 4.0	17	17,374	nw.	73	ne.	5	8	11	12	6.1	14.5
New Haven	106	117	140	29.95	30.07	.00	28.8	— 3.4	53	22	37	— 5	9	21	35	26	21	72	6.49	+ 3.1	17	8,016	n.	38	n.	13	16	4	11	4.4	17.3
Mid. Atlantic States.							**34.2**	**— 3.0**									**77**	**4.36**	**+ 1.6**								**6.2**	
Albany	97	102	115	30.00	30.11	+ .03	23.4	— 5.2	50	22	32	—11	9	14	44	21	18	84	5.13	+ 2.4	16	5,908	nw.	34	se.	29	9	6	16	6.3	33.5
Binghamton	875	79	90	29.10	30.07	— .02	24.6	— 3.9	50	3	33	— 9	15	16	39	....	....	....	2.92	+ 0.1	16	5,332	w.	32	w.	3	4	7	20	7.5	26.6
New York	314	108	350	29.73	30.09	.00	32.2	— 2.2	54	16	38	8	9	26	22	29	24	73	6.19	+ 2.9	16	11,898	w.	56	n.	5	11	6	14	5.7	9.6
Harrisburg	374	94	104	29.70	30.12	.00	30.0	— 4.4	54	3	36	13	10	24	20	27	23	77	4.57	+ 1.5	17	5,934	nw.	33	nw.	18	6	11	14	6.6	14.0
Philadelphia	117	168	184	29.98	30.12	+ .01	33.7	— 1.8	60	22	40	17	9	27	23	31	27	77	6.63	+ 3.9	16	8,896	nw.	52	n.	5	11	7	13	5.4	6.0
Scranton	805	111	119	29.21	30.11	+ .01	27.2	.....	53	3	34	3	9	20	29	25	20	71	4.36	.....	13	6,159	sw.	32	w.	3	5	6	20	7.8	15.8
Atlantic City	52	39	48	30.04	30.11	+ .01	35.8	— 0.6	58	3	43	16	9	29	27	32	29	78	7.15	+ 3.3	16	7,480	nw.	34	nw.	5	11	10	10	5.3	1.4
Cape May	17	47	51	30.10	30.13	+ .02	36.8	— 1.1	58	3	43	16	9	31	25	**34**	....	....	5.81	+ 2.0	16	7,700	nw.	38	ne.	5	5	16	10	6.0	T.
Baltimore	123	69	117	29.97	30.11	— .02	34.8	— 2.7	59	21	40	18	28	29	23	31	26	73	5.66	+ 2.5	15	5,940	nw.	31	nw.	5	11	8	12	5.7	7.0
Washington	112	59	76	30.00	30.13	.00	34.4	— 1.8	60	21	41	16	28	28	23	31	27	76	5.29	+ 2.8	14	5,464	nw.	30	nw.	5	10	8	13	6.0	3.0
Cape Henry	.....	5	58	30.08	30.10	— .02	43.6	— 0.3	70	3	50	24	28	37	32	....	....	....	2.50	— 1.4	12	12,084	nw.	48	n.	1	9	10	12	6.2	T.
Lynchburg	681	83	88	29.35	30.11	— .03	38.4	— 0.9	67	3	46	19	27	30	30	34	29	76	4.03	+ 1.0	11	3,709	nw.	23	nw.	8	10	11	10	5.3	T.
Norfolk	91	102	111	30.03	30.13	.00	43.3	+ 0.5	70	3	51	20	28	36	28	39	35	76	2.42	— 1.2	12	7,575	n.	52	sw.	5	10	10	11	6.0	0.1
Richmond	144	82	90	29.97	30.13	— .01	40.1	.....	68	11	48	20	27	32	31	....	....	....	4.12	.....	14	4,149	n.	24	sw.	10	10	7	14	6.2	1.1
Wytheville	2,293	40	47	27.66	30.11	— .04	35.0	.....	58	16	43	10	27	28	27	31	29	83	2.34	.....	12	5,184	w.	25	w.	3	10	3	18	6.4	4.8
S. Atlantic States.							**42.0**	**+ 0.2**									**73**	**3.67**	**+ 0.2**								**5.2**	
Asheville	2,255	73	100	27.74	30.12	— .04	38.4	.....	67	11	47	11	27	30	37	34	31	80	2.30	.....	9	8,867	n.	38	n.	25	10	8	13	5.9	T.
Charlotte	773	68	76	29.28	30.13	— .03	42.4	— 1.2	64	11	50	16	27	35	25	37	33	74	3.42	— 0.7	11	5,032	ne.	36	sw.	5	12	7	12	5.3	T.
Hatteras	11	12	47	30.10	30.11	— .02	48.8	+ 0.6	71	3	55	27	27	43	28	46	44	85	2.92	— 2.6	11	11,428	n.	60	sw.	5	10	6	15	6.1	
Raleigh	376	93	101	29.72	30.14	— .01	42.4	— 1.5	69	3	51	17	27	34	35	37	32	73	3.15	0.0	13	5,077	ne.	30	sw.	5	11	7	13	5.8	T.
Wilmington	78	82	90	30.02	30.11	— .04	49.0	+ 0.7	73	3	59	19	27	40	33	43	38	75	3.26	+ 0.3	9	6,297	ne.	40	sw.	4	11	11	9	4.9	
Charleston	48	14	92	30.09	30.14	— .01	52.4	+ 0.9	73	13	60	23	27	45	26	48	45	81	4.23	+ 1.0	7	7,581	n.	45	sw.	4	9	15	7	5.0	
Columbia	351	114	122	29.75	30.15	— .01	47.3	— 0.6	71	16	56	18	27	39	32	41	37	74	3.60	+ 0.7	8	5,984	ne.	48	sw.	4	9	9	13	5.9	T.
Augusta	180	89	97	29.94	30.13	— .03	48.0	+ 0.3	71	13	57	19	27	39	31	42	39	78	3.43	0.0	5	4,180	nw.	30	sw.	4	15	6	10	4.6	
Savannah	65	79	89	30.06	30.13	— .02	53.6	+ 1.2	76	13	62	24	27	45	33	47	44	77	3.23	0.0	6	5,575	n.	40	sw.	4	15	7	9	4.4	
Jacksonville	43	101	129	30.06	30.11	— .03	57.1	+ 1.1	79	2	66	24	27	49	32	51	48	78	5.82	+ 3.0	5	6,787	nw.	45	sw.	4	14	9	8	4.3	
Florida Peninsula.							**67.1**	**+ 0.9**									**79**	**1.41**	**— 0.7**								**3.7**	
Jupiter	28	10	30	30.05	30.09	— .01	69.0	+ 2.3	86	1	75	39	27	63	28	62	59	77	0.71	— 2.1	3	8,019	nw.	30	s.	4	16	14	1	3.6	
Key West	22	43	50	30.05	30.07	— .01	70.4	+ 0.4	83	4	74	52	28	67	13	65	63	80	2.12	+ 0.5	7	8,504	ne.	33	nw.	4	16	8	7	4.4	
Tampa	34	60	67	30.07	30.11	— .01	61.8	— 0.1	81	1	71	29	28	52	33	55	52	79	1.39	— 0.5	3	4,747	nw.	40	s.	4	18	9	4	3.0	
East Gulf States.							**49.5**	**— 1.7**									**78**	**5.28**	**+ 0.7**								**5.8**	
Atlanta	1,174	190	216	28.87	30.13	— .03	43.0	— 2.3	67	13	50	15	27	36	23	39	35	79	4.86	+ 0.7	7	10,305	nw.	48	w.	4	9	11	11	5.5	
Macon	370	93	99	29.73	30.14	— .02	47.2	.....	71	13	56	17	27	38	31	....	....	....	2.84	.....	10	4,929	nw.	30	sw.	4	10	6	15	5.8	
Pensacola	56	79	96	30.07	30.13	— .02	53.8	— 0.7	72	2	62	24	27	46	26	....	....	....	3.59	— 0.3	9	7,660	n.	45	sw.	2	11	11	9	5.0	
Mobile	57	88	96	30.08	30.14	— .01	52.2	— 0.2	72	12	60	23	27	44	25	47	43	78	7.35	+ 2.9	10	5,859	n.	31	se.	2	12	8	11	4.9	
Montgomery	223	100	112	29.90	30.13	— .03	48.1	— 1.5	72	2	57	17	27	40	29	43	39	77	5.46	+ 0.8	7	5,361	n.	44	w.	4	9	7	15	6.0	
Meridian	375	84	93	29.72	30.13	— .03	46.8	— 3.7	72	15	56	16	27	38	33	....	....	....	5.40	+ 0.1	9	4,326	se.	28	w.	4	4	12	15	6.7	T.
Vicksburg	247	62	74	29.83	30.10	— .05	48.6	— 2.0	74	15	57	22	27	40	30	44	40	77	4.18	— 0.8	9	5,222	se.	33	nw.	29	6	8	17	6.9	T.
New Orleans	51	88	121	30.07	30.14	+ .01	54.0	— 1.5	78	15	61	28	27	47	24	49	46	79	6.09	+ 1.7	10	6,962	ne.	36	s.	2	9	10	12	5.7	
West Gulf States.							**49.6**	**— 1.8**									**77**	**2.82**	**— 0.5**								**5.7**	
Shreveport	249	77	84	29.86	30.14	+ .01	47.9	— 1.6	70	3	55	25	27	40	33	43	38	74	2.77	— 1.9	7	5,536	se.	28	w.	4	10	8	13	6.0	1.8
Fort Smith	457	79	94	29.62	30.12	— .01	39.4	— 3.4	67	10	46	19	26	32	26	36	32	77	3.26	+ 0.1	11	6,974	e.	35	e.	14	5	9	17	6.9	8.0
Little Rock	357	93	100	29.75	30.14	.00	41.7	— 3.3	66	10	48	17	27	35	28	38	34	77	5.27	+ 1.0	10	5,687	nw.	31	nw.	4	12	5	14	6.1	1.0
Corpus Christi	20	48	53	30.09	30.10	— .02	59.0	— 0.3	80	12	66	36	4	53	24	55	51	80	2.34	+ 1.0	8	6,862	n.	36	nw.	3	8	12	11	6.2	
Fort Worth	670	106	114	29.38	30.11	— .01	45.7	.....	77	11	55	23	4	36	29	....	....	....	1.05	.....	10	8,057	n.	38	sw.	10	13	8	10	4.5	
Galveston	54	106	112	30.04	30.10	— .02	56.7	— 0.4	72	12	62	34	4	51	29	53	50	83	1.93	— 2.1	10	9,267	se.	46	nw.	3	12	9	10	5.1	
Palestine	510	73	79	29.59	30.12	.00	49.2	— 2.2	73	12	57	26	4	42	31	44	40	78	1.67	— 2.1	9	5,093	s.	23	sw.	2	10	6	15	6.2	0.5
San Antonio	701	80	91	29.37	30.10	— .01	53.2	— 1.7	73	12	62	33	16	44	32	47	42	72	2.51	+ 0.6	8	5,217	se.	35	nw.	3	11	6	14	5.5	
Taylor	583	55	63	29.49	30.11	.00	50.2	.....	79	12	59	31	27	41	32	....	....	....	2.03	.....	10	6,541	nw.	30	s.	19	12	9	10	5.1	
Ohio Val. and Tenn.							**55.7**	**— 2.5**									**79**	**4.99**	**+ 1.5**								**7.5**	
Chattanooga	762	106	112	29.34	30.17	+ .01	41.6	— 2.0	68	11	49	16	27	34	24	37	32	73	3.61	— 0.7	9	5,402	nw.	41	sw.	4	10	8	13	5.9	T.
Knoxville	1,004	10	88	29.06	30.15	— .01	39.6	— 0.3	65	13	47	15	27	32	25	36	33	81	3.46	— 0.6	10	5,896	sw.	48	sw.	4	4	7	20	7.5	T.
Memphis	397	140	154	29.72	30.16	+ .01	42.2	— 1.4	66	11	48	15	27	36	28	38	34	76	8.09	+ 3.9	9	7,953	nw.	52	sw.	2	12	1	18	5.9	
Nashville	546	122	131	29.56	30.16	+ .01	40.0	— 1.7	67	2	47	12	27	33	27	36	32	78	6.58	+ 2.8	12	5,851	nw.	38	sw.	2	9	6	16	6.5	0.4
Lexington	989	75	102	29.04	30.14	.00	34.2	— 3.9	60	2	41	9	26	28	28	....	....	....	6.60	+ 3.2	17	8,667	sw.	40	s.	15	3	7	21	7.9	4.5
Louisville	525	114	136	29.55	30.16	+ .02	34.8	— 3.6	65	2	41	9	26	29	33	32	28	77	5.65	+ 1.8	12	7,373	sw.	40	s.	2	4	5	22	8.0	2.0
Evansville	431	72	82	29.65	30.14	+ .01	34.8	.....	60	11	41	6	26	29	25	....	....	....	5.04	.....	12	6,452	nw.	54	sw.	3	5	3	23	7.6	5.0
Indianapolis	822	154	164	29.20	30.11	— .01	29.7	— 3.4	53	11	36	5	26	23	25	27	25	84	4.06	+ 0.9	17	9,462	s.	48	sw.	2	4	8	19	7.5	0.8
Cincinnati	628	152	157	29.43	30.13	.00	33.0	— 3.6	62	2	40	7	31	26	33	31	28	81	5.25	+ 2.1	17	6,728	sw.	36	sw.	2	2	9	20	8.1	7.8
Columbus	824	87	100	29.20	30.11	— .01	30.7	— 2.6	55	2	37	7	31	24	25	28	26	83	3.41	+ 0.5	17	10,474	sw.	42	sw.	3	3	8	20	7.8	10.7
Pittsburg	842	116	123	29.17	30.11	.00	32.2	— 2.8	60	3	38	11	26	26	24	29	25	76	3.71	+ 0.8	16	5,512	nw.	23	nw.	3	3	7	21	8.1	10.6
Parkersburg	638	77	84	29.44	30.14	.00	34.2	— 2.4	62	21	40	13	26	28	34	31	28	82	4.45	+ 1.7	16	5,221	w.	32	nw.	24	1	3	27	9.1	2.8
Elkins	1,940	41	50	28.00	30.11	— .01	31.8	.....	59	21	40	9	31	24	38	29	26	81	5.88	.....	22	4,340	w.	28	s.	16	1	11	19	8.1	11.3
Lower Lake Region.							**37.5**	**— 3.0**									**82**	**3.10**	**+ 0.2**								**8.1**	
Buffalo	767	178	206	29.20	30.06	.00	27.6	— 2.2	51	3	33	6	9	22	30	26	22	76	3.57	+ 0.2	25	15,438	w.	65	w.	3	0	2	28	9.3	24.7
Oswego	335	76	91	29.68	30.07	+ .01	24.3	— 5.1	48	3	31	—12	9	18	33	23	21	86	4.73	+ 1.3	19	10,334	se.	35	nw.	3	2	6	23	8.2	31.4
Rochester	523	81	90	29.48	30.07	+ .01	26.6	— 2.0	53	3	33	6	15	21	29	25	22	83	3.46	+ 0.6	17	8,096	sw.	36	sw.	3	2	4	25	8.7	27.7
Syracuse	597	97	113	29.39	30.05	— .02	23.8	.....	52	2	31	—11	9	17	28	....	....	....	3.68	.....	19	10,068	sw.	58	s.	16	2	11	18	7.6	30.9
Erie	713	92	102	29.27	30.06	— .01	28.8	— 3.6	54	3	34	10	25	24	18	27	24	81	1.97	— 1.2	20	11,193	sw.	49	s.	15	1	4	26	8.6	14.4
Cleveland	762	190	201	29.23	30.07	— .02	28.8	— 2.4	55	21	35	6	31	23	26	27	23	78	3.67	+ 1.0	21	13,646	sw.	50	w.	8	2	7	22	8.5	29.1
Sandusky	629	62	70	29.38	30.09	.00	29.2	— 3.3	53	21	35	8	27	24	22	....	....	....	2.40	0.0	17	7,988	sw.	31	ne.	13	6	7	18	7.1	15.5
Toledo	628	123	127	29.38	30.09	+ .01	27.4	— 3.3	49	21	34	5	27	21	24	25	23	83	2.25	— 0.1	16	9,396	sw.	36	w.	4	5	5	21	7.5	10.9
Detroit	730	153	193	29.25	30.07	.00	27.0	— 2.5	46	21	32	8	31	22	21	25	23	85	2.73	+ 0.2	16	11,055	sw.	37	ne.	13	2	8	21	7.7	13.8
Upper Lake Region.							**33.4**	**— 1.1**									**82**	**2.02**	**— 0.1**								**7.7**	
Alpena	609	63	80	29.37	30.06	+ .04	24.0	— 0.8	42	19	30	2	14	19	25	23	21	86	1.75	— 0.7	11	9,380	w.	37	se.	15	3	3	25	8.7	9.9
Escanaba	612	43	57	29.37	30.06	+ .03	22.8	+ 1.4	40	1	29	— 2	9	17	23	22	19	84	1.38	— 0.6	11	7,275	nw.	36	n.	3	8	3	20	7.0	9.0
Grand Haven	632	54	92	29.34	30.06	+ .01	28.1	— 1.5	46	1	33	10	14	24	21	26	24	85	2.60	0.0	14	11,370	sw.	39	sw.	29	2	5	24	8.8	14.8
Houghton	668	66	74	29.31	30.06	+ .04	21.6	.....	44	18	27	— 2	12	16	28	....	....	....	4.60	.....	20	5,494	nw.	27	n.	24	3	6	22	8.0	37.7
Marquette	734	79	116	29.23	30.06	+ .04	23.2	+ 0.4	42	18	28	4	9	18	21	21	16	74	3.79	+ 1.3	19	9,160	nw.	38	nw.	24	2	8	21	8.2	43.3
Port Huron	638	70	120	29.37	30.08	+ .02	25.9	— 1.9	47	21	31	5	14	20	23	24	21	84	1.43	— 0.9	12	10,851	sw.	40	ne.	13	5	5	21	7.9	8.3
Sault Ste. Marie	614	40	61	29.33	30.03	+ .03	19.6	— 3.0	42	19	26	— 5	26	13	31	18	14	78	1.71	— 0.4	15	7,351	e.	36	nw.	10	2	5	24	8.2	15.8
Chicago	823	241	274	29.18	30.10	+ .02	26.5	— 2.8	50	1	32	— 1	8	21	26	25	23	86	1.90	— 0.4	14	15,476	w.	58	ne.	2	7	8	16	7.0	5.3
Milwaukee	681	124	142	29.32	30.10	+ .04	25.8	+ 0.2	44	1	31	— 2	8	20	25	24	21	83	1.82	— 0.2	11	10,358	w.	43	ne.	2	6	4	21	7.5	8.6
Green Bay	617	49	57	29.39	30.08	+ .04	22.2	— 1.6	42	1	28	— 7	9	16	29	20	16	77	1.78	— 0.2	15	8,675	sw.	46	n.	2	3	7	21	8.2	13.6
Duluth	702	95	116	29.30	30.12	+ .07	16.4	— 1.4	37	18	24	—17	26	9	37	15	12	81	2.03	+ 0.7	16	8,932	sw.	56	nw.	24	10	10	11	5.6	18.8
North Dakota.							**8.0**	**— 5.2**									**79**	**0.60**	**— 0.1**								**4.2**	
Moorhead	935	54	60	29.10	30.18	+ .10	9.6	— 2.3	36	17	18	—23	26	1	31	8	7	91	1.02	+ 0.3	8	8,127	nw.	38	se.	23	14	6	11	5.1	8.8
Bismarck	1,674	16	29	28.30	30.20	+ .12	10.0	— 4.7	45	31	20	—24	25	0	43	7	1	68	0.10	— 0.6	2	7,061	nw.	52	nw.	23	15	7	9	4.8	1.0

TABLE I.—*Climatological data for Weather Bureau Stations, December, 1902*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.									Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
North Dak.—Cont'd.																														
Williston	1,885	14	44	28.03	30.14	+.08	4.3	−8.7	35	31	15	−28	12	−7	38	3	−1	78	0.68	0.0	10	6,108	n.	40	nw.	23	13	8	10	4.6	8.9
Upper Miss. Valley.							25.0	+3.4										82	2.72	+0.7									6.8	
Minneapolis		99	208				15.6	−4.5	39	1	23	−20	26	8	25				2.61	+1.1	12	9,047	nw.	42	n.	2	5	10	16		24.0
St. Paul	837	102	122	29.17	30.12	+.04	15.9	−2.9	38	1	23	−17	26	9	28	15	12	84	2.48	+1.2	12	5,894	nw.	30	nw.	24	7	6	18	7.0	17.4
La Crosse	714	71	87	29.32	30.13	+.05	19.8	−3.8	44	31	27	−10	8	13	29				2.03	+0.6	12	6,139	s.	27	ne.	2	4	12	15	7.1	13.0
Davenport	606	71	79	29.43	30.10	.00	24.2	−3.6	49	1	30	−7	8	18	30	22	19	84	1.88	+0.2	9	6,394	w.	32	w.	24	9	3	19	6.9	5.9
Des Moines	861	84	88	29.18	30.16	+.05	22.4	−4.4	50	1	29	−7	26	15	32	20	18	85	1.77	+0.3	10	6,740	sw.	28	nw.	24	4	10	17	7.4	15.9
Dubuque	698	100	117	29.33	30.12	+.02	21.9	−4.0	44	1	28	−6	8	16	26	19	15	79	2.24	+0.4	12	5,359	nw.	25	nw.	24	9	3	19	7.3	12.1
Keokuk	614	63	78	29.43	30.12	.00	27.0	−2.8	56	1	33	−2	26	21	26	24	21	83	2.21	+0.2	9	6,452	sw.	32	nw.	24	8	6	17	6.6	6.1
Cairo	356	87	93	29.76	30.16	+.01	37.0	−2.2	64	11	43	8	26	30	25	34	31	82	6.95	+3.6	12	7,556	nw.	42	sw.	2	6	9	16	6.6	0.2
Springfield, Ill	644	82	93	29.41	30.12	.00	28.6	−4.2	54	1	34	0	26	23	31	26	24	83	2.23	−0.5	14	7,986	sw.	33	nw.	24	8	4	19	6.7	2.7
Hannibal	534	75	110	29.52	30.12	.00	28.7	−3.2	56	1	35	−1	26	22	27				1.76	+0.1	11	7,560	n.	31	ne.	14	9	5	17	6.4	5.2
St. Louis	567	111	210	29.50	30.12	−.01	34.0	−1.6	56	1	40	5	26	28	24	31	26	76	3.81	+1.0	14	8,543	s.	38	sw.	2	11	4	16	6.4	1.7
Missouri Valley.							22.1	−0.5										82	2.16	+1.1									6.4	
Columbia	784	11	84	29.25	30.11	−.01	30.0	−4.8	57	1	36	0	26	24	27				2.20	+0.4	13	6,868	sw.	32	nw.	24	11	2	18	6.4	0.5
Kansas City	963	78	95	29.08	30.16	+.04	29.0	−2.9	56	1	36	0	26	22	23	27	24	82	1.89	+0.4	7	5,647	nw.	28	nw.	24	9	4	18	6.3	4.4
Springfield, Mo	1,324	98	104	28.67	30.12	−.01	32.9	−5.7	60	11	40	2	26	26	24	31	29	87	3.34	+0.7	11	8,385	nw.	27	w.	15	11	3	17	6.3	3.9
Topeka		81	89				27.9	−6.9	58	1	36	0	26	20	30				1.26	+0.3	9	6,862	s.	31	sw.	1	8	4	19	6.6	6.0
Lincoln	1,189	75	84	28.80	30.13	+.01	22.0	−8.4	52	1	36	−7	26	15	28	20	17	82	1.96	+1.2	11	8,183	nw.	36	nw.	3	10	3	18	6.3	13.6
Omaha	1,105	115	121	28.90	30.14	+.03	21.5	−5.2	50	1	29	−8	26	14	31	19	17	85	2.72	+1.7	11	6,906	n.	31	nw.	24	6	9	16	7.0	14.1
Valentine	2,598	47	54	27.26	30.10	.00	18.6	−8.6	52	1	28	−7	25	9	36	16	14	86	1.28	+0.9	11	8,348	nw.	39	nw.	23	10	10	11	5.4	12.8
Sioux City	1,135	96	164	28.86	30.14	+.02	17.7	−6.4	46	1	25	−15	26	11	26				1.43	+0.6	9	9,364	nw.	50	nw.	24	9	5	17	6.5	18.2
Pierre	1,572	43	50	28.40	30.16	+.06	15.4	−9.3	44	9	22	−14	26	9	34	13	9	77	2.21	+1.8	8	5,738	e.	36	se.	27	9	10	12	5.7	23.1
Huron	1,306	56	67	28.69	30.16	+.06	11.0	−8.2	41	1	20	−26	26	2	36	10	6	78	2.12	+1.5	9	9,139	se.	51	se.	27	10	7	14	6.0	14.7
Yankton	1,233	42	49	28.77	30.16	+.05	17.4	−5.1	52	1	26	−20	26	8	35				3.32	+2.5	10	5,661	nw.	30	nw.	23	4	8	19	7.4	21.4
Northern Slope.							20.6	−3.9										80	0.73	+0.2									5.6	
Havre	2,505	46	53	27.34	30.12	+.07	9.6	−11.0	41	30	18	−24	11	1	37	9	7	87	0.52	−0.1	6	7,043	ne.	48	sw.	30	8	6	17	6.4	5.2
Miles City	2,371	42	50	27.48	30.10	.00	16.0	−3.3	54	1	26	−6	7	6	36	14	12	94	0.22	−0.1	7	3,432	s.	27	nw.	1	15	12	4	3.6	2.2
Helena	4,110	88	94	25.77	30.12	−.01	22.1	−3.2	58	9	30	−6	7	14	40	20	16	77	0.75	−0.2	7	3,944	sw.	34	sw.	9	4	15	12	6.5	7.9
Kalispell	2,965	45	51	26.91	30.07	.00	24.8		40	1	31	6	7	19	24	24	22	87	2.24		17	2,807	w.	27	sw.	23	1	4	26	9.0	19.8
Rapid City	3,234	46	50	26.57	30.08	−.01	23.4	−6.8	62	9	33	−3	7	13	48	20	16	77	0.80	+0.6	7	5,939	w.	35	nw.	28	12	5	14	5.5	8.0
Cheyenne	6,088	56	64	23.92	30.06	−.03	28.6	+0.1	56	26	39	5	16	19	37	23	16	62	1.79	+1.5	9	9,645	nw.	52	w.	27	14	7	10	4.7	19.3
Lander	5,372	26	36	24.60	30.16	+.01	22.6	+1.8	53	10	36	−8	3	10	41	17	13	73	0.25	−0.5	1	2,332	ne.	30	e.	27	19	11	1	3.4	2.5
North Platte	2,821	43	52	27.09	30.15	+.05	22.2	−4.9	59	1	31	−1	16	13	36	19	16	82	0.78	+0.2	8	5,932	w.	30	nw.	2	10	10	11	5.8	9.0
Middle Slope.							30.8	−4.0										75	0.75	−0.2									5.0	
Denver	5,291	79	151	24.67	30.06	−.02	33.2	+1.2	65	8	45	8	15	22	44	25	17	59	0.59	−0.1	5	6,412	s.	45	nw.	2	14	10	7	4.2	11.5
Pueblo	4,685	80	86	25.25	30.06	−.02	32.2	−1.5	71	9	46	0	16	18	48	25	17	58	0.52	0.0	3	4,980	nw.	40	w.	27	15	12	4	4.0	5.2
Concordia	1,398	42	47	28.61	30.14	+.03	25.0	−8.0	57	1	32	0	26	18	29	22	19	83	0.75	+0.2	7	5,098	s.	24	nw.	3	9	5	17	6.4	7.2
Dodge	2,509	44	54	27.44	30.14	+.04	27.6	−5.0	61	1	38	−5	17	18	35	23	20	84	0.28	−0.4	2	7,543	w.	35	s.	1	15	6	10	4.2	4.5
Wichita	1,358	78	85	28.66	30.14	+.03	30.6	−7.3	62	10	39	7	26	22	36	28	25	85	0.69	−0.3	7	6,736	ne.	29	n.	3	11	7	13	5.5	3.1
Oklahoma	1,214	79	86	28.80	30.12	+.01	36.4	−3.7	70	10	44	12	4	28	31	32	29	80	1.68	−0.4	8	8,351	n.	38	sw.	10	10	10	11	5.6	1.8
Southern Slope.							40.6	−1.2										72	0.47	−0.8									4.6	
Abilene	1,738	45	54	28.26	30.11	.00	44.9	−2.6	73	6	54	22	4	35	30	38	33	72	0.39	−1.1	5	6,507	nw.	30	w.	2	11	12	8	5.1	0.1
Amarillo	3,676	43	52	26.24	30.06	−.03	36.4	+0.1	73	9	48	12	5	25	46	29	24	73	0.55	−0.4	5	9,680	sw.	42	n.	3	18	8	5	4.1	5.5
Southern Plateau.							42.1	−0.4										52	0.86	−0.4									3.5	
El Paso	3,762	10	110	26.22	30.05	+.02	46.4	+0.3	71	8	58	27	4	35	37	37	29	58	0.78	+0.2	6	7,519	nw.	49	nw.	2	17	10	4	3.5	T.
Santa Fe	7,013	47	50	23.22	30.11	+.05	31.2	+0.4	57	9	40	9	29	22	32	24	16	56	0.78	−0.1	6	5,394	n.	35	nw.	4	23	4	4	2.6	5.2
Flagstaff	6,907	12	25	23.34	30.09	+.03	27.8	−2.7	58	24	42	−12	15	14	50	22			1.74	−1.3	6		ne.				16	11	4	3.8	16.9
Phoenix	1,108	50	56	28.87	30.05	+.01	51.8	−0.8	78	26	64	32	4	40	36	43	35	59	1.06	+0.2	2	2,339	w.	29	n.	2	18	9	4	3.7	
Yuma	141	16	59	29.89	30.04	−.01	55.0	−0.9	75	8	66	33	2	44	34	44	32	46	0.78	+0.3	2	4,508	n.	33	n.	3	23	3	5	2.1	
Independence	3,910	51	58	26.04	30.09	−.03	40.4	+1.1	70	26	51	22	19	30	40	32	18	43	0.04	−2.0	1	4,241	nw.	32	sw.	26	13	11	7	5.1	T.
Middle Plateau.							31.8	+0.6										68	0.58	−0.8									4.8	
Carson City	4,720	82	92	25.30	30.09	−.06	36.8	+2.6	67	24	48	11	29	26	42	31	24	63	0.45	−1.7	4	4,967	s.	44	sw.	9	12	13	6	4.3	T.
Winnemucca	4,344	59	70	25.64	30.11	−.07	32.8	+1.7	62	25	45	2	30	21	38	29	24	71	0.08	−1.2	4	5,907	ne.	52	w.	4	13	7	11	5.4	0.1
Modena	5,479	10	38	24.64	30.14	+.02	29.6		56	8	40	2	21	19	34	24	19	70	0.29		5	5,851	w.	28	ne.	14	14	11	6	4.1	4.0
Salt Lake City	4,366	105	110	25.68	30.15	.00	33.5	+0.7	58	9	40	15	3	27	25	29	23	65	1.31	−0.3	9	3,468	se.	38	n.	1	10	8	13	5.9	9.5
Grand Junction	4,608	43	51	25.48	30.28	+.18	24.2	−2.6	51	8	34	0	22	14	29	20	14	69	0.50	+0.1	4	2,650	e.	17	nw.	2	12	12	7	4.4	5.0
Northern Plateau.							32.7	+0.4										82	1.84	−0.1									7.6	
Baker City	3,471	53	58	26.46	30.13	−.03	28.8	+0.3	49	25	35	6	17	23	18	26	23	79	2.43	+0.7	15	4,220	se.	22	se.	26	6	3	22	7.4	19.4
Boise	2,739	61	68	27.25	30.19	−.01	35.4	+2.2	59	9	42	17	17	28	24	31	27	77	1.01	−0.9	11	3,054	se.	29	sw.	1	7	9	15	7.0	3.8
Lewiston	757	52	61	29.25	30.08	−.05	36.9	−0.5	51	4	42	23	19	32	16				1.70		12	2,763	e.	26	w.	1	2	7	22	8.2	5.9
Pocatello	4,482	46	54	25.52	30.17	−.02	29.8	+3.8	53	26	37	7	30	22	25	27	23	74	0.98	−0.6	8	7,588	e.	38	sw.	27	7	14	10	5.7	8.4
Spokane	1,943	101	110	27.98	30.09	+.01	30.9	−0.4	46	26	35	18	16	27	13	29	28	87	2.31	−0.2	16	4,268	s.	33	sw.	1	0	3	28	9.2	14.7
Walla Walla	1,000	65	73	29.00	30.11	−.01	34.4	−3.3	58	26	39	22	21	30	23	33	31	91	2.45	+0.3	15	4,015	s.	32	s.	3	3	4	24	7.9	5.7
N. Pac. Coast Reg.							41.8	−0.3										88	11.09	+2.3									8.4	
North Head	211	11	56	29.72	29.95	−.08	44.2	+0.4	55	24	48	34	27	40	16	43	42	93	10.80	+0.9	23	17,809	se.	74	se.	3	1	2	28	9.0	T.
Port Crescent	259	13	20	29.65	29.90	−.08	38.4	−1.0	56	25	44	27	7	33	21				12.99	+6.1	23	2,774	sw.	20	sw.	25	1	6	24	8.7	
Seattle	123	114	151	29.86	29.99	−.02	41.8	0.0	55	25	46	30	17	38	15	40	38	85	8.82	+2.7	23	6,454	se.	36	se.	12	2	10	19	7.9	0.4
Tacoma	213	113	120	29.76	29.99	−.02	40.6	−0.3	60	25	45	29	18	36	22				10.44	+3.0	23	5,016	sw.	30	sw.	25	0	0	31	9.8	3.6
Tatoosh	86	7	57	29.78	29.89	−.07	42.4	−0.9	54	25	46	34	11	39	16	41	39	88	11.97	−2.5	27	17,459	e.	76	sw.	25	3	10	18	7.3	T.
Astoria	20	57	64	29.93	29.95	−.08	43.8	−0.2	59	25	49	33	18	38	20				15.29	+4.1	24		e.				2	2	27	8.5	T
Portland, Oreg	154	68	96	29.86	30.03	−.04	40.4	−0.9	58	24	44	30	18	36	20	39	36	85	10.28	+2.5	21	4,311	se.	28	sw.	30	3	4	24	8.4	0.7
Roseburg	518	56	67	29.48	30.05	−.06	42.4	+0.4	68	8	48	24	18	37	24	40	38	87	8.10	+1.6	22	2,066	sw.	24	sw.	26	3	6	22	7.9	
Mid. Pac. Coast Reg.							48.7	+0.2										82	3.89	−1.5									5.8	
Eureka	62	62	80	30.02	30.09	−.03	49.8	+2.0	66	25	55	34	28	44	19	46	43	79	8.33	+1.0	17	5,236	s.	28	s.	10	8	6	17	6.5	
Mount Tamalpais	2,375	11	18	27.60	30.11	−.01	44.4		60	23	48	33	15	40	14	41	38	82	3.27		11	13,552	sw.	56	sw.	9	11	7	13	5.7	
Red Bluff	332	50	56	29.76	30.13	−.01	45.2	−1.5	59	7	52	29	30	39	24	43	40	83	3.39	−1.9	13	3,747	n.	24	se.	7	7	13	11	5.7	
Sacramento	69	106	117	30.05	30.12	−.02	46.9	−0.2	66	7	53	32	31	41	24	44	42	84	2.91	−1.2	5	5,345	se.	27	nw.	2	10	4	17	5.9	
San Francisco	155	161	167	29.97	30.14	+.02	50.6	−0.8	62	7	55	39	30	46	13	48	45	81	2.32	−2.7	11	4,442	n.	28	s.	10	9	10	12	5.4	
Point Reyes Light	490	7	30	29.54	30.06		51.2	+1.3	59	24	55	40	29	47	16				2.48	−2.9	11	12,225	se.	58	nw.	13	10	5	16	5.9	
S. Pac. Coast Reg.							52.8	+0.1										72	2.02	−1.0									4.4	
Fresno	330	67	70	29.76	30.13	.00	46.9	+0.6	72	25	55	29	29	39	31	43	40	80	0.54	−1.0	3	2,626	e.	14	s.	11	10	7	14	5.9	
Los Angeles	338	116	123	29.69	30.06	−.01	56.0	+0.6	80	8	66	39	31	46	29	48	41	67	2.50	−1.5	6	3,815	ne.	30	nw.	13	13	13	5	3.9	
San Diego	87	94	102	29.96	30.06	−.01	55.8	0.0	74	8	63	40	14	49	22	49	44	72	3.58	+1.4	7	3,796	nw.	23	nw.	13	21	5	5	3.3	
San Luis Obispo	201	46	48	29.90	30.13	+.02	52.6	−0.8	74	8	63	32	15	42	35	46	40	69	1.48	−3.0	5	3,361	n.	21	n.	28	15	8	8	4.4	
West Indies.																														
Basseterre	29	41	54	29.92	29.95	−.01	78.0		86	24	83	68	21	73	15	73	70	77	3.30		20	5,605	e.	29	se.	18	8	17	6	4.9	
Bridgetown	30	57	65	29.90	29.93	+.01	78.6	+1.9	86	14	84	70	8	73	16	74	72	80	4.76	+1.7	19	5,280	e.	22	ne.	16	12	10	9	5.1	
Cienfuegos	52	62	67																											
Grand Turk	11	6	20	29.97	29.98	−.03	77.2		87	1	82	68	21	72	16				6.30		21		e.				9	12	10	5.5	
Havana	57	87	105	29.98	30.04	.00	72.6	+1.2	85	12	78	56	28	68	17	67	64	78	0.58	−1.6	7	9,924	e.	41	e.	31	11	13	7	4.9	
Kingston	286	38	52																											
Puerto Principe	352	55	62	29.65	30.01	+.03	72.8		90	5	81	54	25	64	25	68	67	92	2.72		12	5,072	ne.	28	e.	10	13	11	7	4.8	
San Juan	82	48	90	29.88	29.95	−.02	77.1		86	27	82	69	20	72	13	72	71	86	7.16	+2.9	22	6,137	se.	30	e.	16	13	8	10	5.4	
Santiago de Cuba	82	46	52	29.87	29.96	−.02	76.0		89	5	84	64	22	68	21	69	68	83	1.28		8	5,552	n.	24	nw.	9	17	9	5	4.2	
Santo Domingo †	57	37	44	29.92	29.98	+.01	76.3		87	11	84	65	20	69	18	71	70	88	1.07		11	3,036	n.	15	e.	10	5	15	2	4.7	

NOTE.—The data at stations having no departures are not used in computing the district averages. * More than one date. † Record for first 22 days of month.

TABLE II.—*Climatological record of voluntary and other cooperating observers, December, 1902.*

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Ashville	66	14	43.4	6.12	
Benton				6.88	
Bermuda	78	18	48.6	8.05	
Birmingham	68	13	45.7	5.44	
Bridgeport				4.64	
Burkeville				7.05	
Calera				7.04	
Camphill	70[g]	22[g]	46.2[g]	4.80	
Citronelle	74	20	52.2	7.91	
Clanton	69	14	43.6	7.67	
Cordova	72	13	44.0	5.30	
Daphne	76	18	52.8	6.64	
Decatur	72[c]	14[c]	45.0[c]	4.80	
Demopolis				5.38	
Dothan	74	17	52.0	2.99	
Eufaula	73	17	48.2	5.59	
Eutaw	69	16	45.8	5.60	
Evergreen	73	13	50.1	4.65	
Flomaton	77	19	50.9	5.77	
Florence *a*				6.14	
Florence *b*	69	10	42.4	5.75	3.5
Fort Deposit	71	16	47.0	8.74	
Gadsden	70	14	42.5	6.79	
Goodwater	71	13	43.0	5.76	
Greensboro	70	16	46.1	5.91	
Greenville				4.37	
Hamilton	69[d]	8[d]	42.3[d]	5.34	T.
Helena				5.82	
Highland Home	74	15	49.1	7.34	
Letohatchie				9.20	
Lock No. 4	70[f]	14[f]	45.4[f]	7.00	
Madison Station	68	13	44.0	4.05	
Maplegrove	71	14	41.5	5.91	
Marion	69	11	45.4	3.68	
Milstead				6.35	
Newbern	72	16	47.4	5.58	
Newburg	70	8	41.0	6.99	T.
Notasulga				6.38	
Oneonto	68	9	42.4	4.44	T.
Opelika	70	14	44.6	6.27	
Ozark	73	17	48.7	3.67	
Prattville	70	15	46.4	6.55	
Pushmataha	72	18	46.9	5.66	
Riverton	70	9	40.4	7.08	T.
Scottsboro	65	15	40.4	4.51	T.
Selma	70	16	45.3	5.90	
Talladega	72	13	44.6	6.15	
Tallassee				5.24	
Thomasville	71			2.50	
Tuscaloosa	70	14	43.8	4.86	
Tuskegee	73	16	48.8	6.51	
Union Springs	71	15	47.8	7.35	
Uniontown	74	15	47.4	5.75	
Valleyhead	78	12	42.4	3.83	
Verbena				6.65	
Wetumpka	72	17	48.4	5.34	
Alaska.					
Killisnoo	41	10	23.7	2.90	19.5
Orca	39	7	24.0	11.40	45.0
Sitka	46	8	27.4	5.93	28.0
Arizona.					
Allaire Ranch				2.22	
Arizona Canal Co's Dam	75	39	56.2	2.32	
Aztec	79	33	55.9	1.25	
Benson[e1]	78	34	51.9		T.
Bisbee	70	25	45.3	1.85	0.5
Bowie	72	21	51.0	1.25	0.5
Buckeye	74	29	49.6	1.20	
Champie Camp	84	20	48.4	0.90	
Casagrande				1.70	
Cochise[e5]	74	29	46.1	2.68	
Congress	76	34	51.0	1.10	
Dragoon Summit[e1]	63	30	41.2	2.70	T.
Dudleyville	80	20	48.3	3.01	T.
Duncan	73	15	42.6	1.62	
Fort Apache	70	10	44.2	2.18	0.3
Fort Defiance	52	−16	22.9	1.05	8.0
Fort Grant	71	20	44.5	2.60	T.
Globe	67	23	45.8	2.35	T.
Jerome	64	21	42.8	1.60	10.0
Maricopa	73	27	49.0	1.20	
Mesa	80	24	50.4	1.19	
Mesa (near)	76	29	49.8	1.13	
Mohawk Summit[e1]	64	40	53.5	1.15	
Mount Huachuca	70	24	47.2	3.66	3.0
Natural Bridge				2.33	
Oracle	68	27	47.6	3.21	2.0
Oro				2.22	
Phoenix	77	28	50.4	1.05	
Pima	72	19	44.7	1.55	
Pinal Ranch				4.62	
Prescott	62	9	33.6	0.12	2.2
Sentinel[e1]	67	40	53.0	1.04	
Showlow				2.47	7.0
Signal				0.60	
Superstition				2.53	
Taylor	69	7	33.2	0.61	
Tonto	69	20	45.2	2.20	
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Tuba	60	10	31.7	0.15	3.0
Tucson	78	26	50.3	2.15	
Vail[e5]	80	32	56.4	0.85	T.
Walnut Grove				0.06	
Willcox[e1]	57	23	43.0	1.00	T.
Yarnell				1.01	1.5
Arkansas.					
Alco	59	10	38.5	6.23	10.0
Amity	67	18	41.2	5.27	4.0
Arkadelphia		25		5.31	3.5
Arkansas City				5.36	T.
Batesville	68	9	40.6	5.67	
Beebranch	68[c]	14[c]	42.0[c]	6.00	T.
Blanchard	70	19	45.4	5.07	3.0
Brinkley	69	15	41.9	6.16	
Camden *a*				5.45	3.0
Camden *b*	70	22	44.2	5.77	3.0
Conway	66	14	40.4	6.24	2.0
Corning	62	11	37.0	6.23	
Dallas	65	18	40.2	6.28	6.5
Dardanelle				4.96	0.4
De Queen	71[c]	22[c]	43.4[c]	3.48	3.0
Dutton	71	12	37.4	5.43	10.0
Elon	75[f]	25[f]	46.3[c]	4.27	0.5
Eureka Springs	62	8	37.3	3.97	6.5
Fayetteville	62[d]	8[d]	34.2[d]	5.01	16.6
Forrest City	82	15	40.8	7.17	
Fulton				.496	
Hardy	63	9	38.8	5.26	
Helena *a*				11.88	
Jonesboro	64[d]	13[d]	39.5[d]	6.83	
Lake Village	67	21	45.2	4.17	
Latherville	61	15	41.2	5.68	5.0
Malvern	67	17	41.6	6.55	0.5
Marianna	65	15	41.9	9.75	
Marvell	68	16	43.2	10.20	
Mossville	59	10	35.7	5.13	1.6
Mountain Home	63	9	35.9	4.46	4.0
Mount Nebo	62	12	37.0	5.01	6.0
New Gascony	70[c]	18[c]	40.6[c]	8.01	
Newport *a*				6.98	
Newport *b*	64	14	39.6	5.22	
Newport *c*	64	15	40.4	7.75	
Oregon	63	5	35.8	4.12	8.0
Ozark	65[f]	16	39.5[c]	5.42	1.5
Perry	68	18	41.2	7.46	6.0
Pinebluff	71	19	41.5	7.02	
Pocahontas	61	8	37.6	5.15	T
Pond	63	7	35.6	4.38	4.0
Prescott	70	20	43.9	5.15	3.5
Princeton	70	17	42.8	6.27	
Rison	71	14	42.2	7.86	
Rosadale	71	20	44.2	4.75	5.0
Russellville	80[d]	18[d]	39.2[d]	4.45	6.0
Silversprings	62	8	36.6	3.76	6.4
Spielerville	67	17	39.4	6.32	11.5
Stuttgart	68	15	42.4	7.69	T.
Texarkana	69	20	45.2	2.80	4.0
Warren	72	17	43.6	7.36	
Washington	68	20	44.0	4.60	2.0
Wiggs	66	13	40.7	6.11	6.5
Winchester	70[c]	19[c]	45.0[c]		
Winslow	59	9	34.6	4.32	12.0
Witts Springs	61	7	36.2	6.05	12.0
California.					
Angiola	75	22	44.6	0.54	
Azusa	78	36	54.8	3.14	
Bakersfield	76	27	47.2	0.36	
Ballast Point L. H				3.10	
Berkeley	60	36	48.2	3.69	
Bishop	69	11	38.4	0.03	
Boca[e1]	55	2	27.0	1.60	6.0
Bodie	54	−19	22.2	0.15	1.5
Bowman	57	18	36.0	12.99	34.3
Branscomb				15.66	0.5
Campbell	68	28	47.0	0.86	
Campo				3.04	
Cape Mendocino L. H				9.30	
Cedarville	59	7	32.6	2.09	3.0
Chico	68[d]	25[d]	46.2[c]	2.92	
Cisco[e1]	45	20	29.6	6.50	65.0
Cloverdale	65	30	47.2	4.45	
Colusa	59	29	45.2	1.62	
Corning[e1]	70	30	47.6	1.97	6.0
Coronado	79	41	57.4	3.73	
Crescent City	59	32	47.0	17.29	T.
Crescent City L. H				17.23	
Cuyamaca	63	19	36.5	3.66	2.5
Delano[e1]	68	31	46.8	0.22	
Delta[e1]	61	31	44.4	9.68	1.5
Drytown	65	28	45.1	2.59	
Dunnigan[e1]	65	29	47.2	1.09	
Durham[e5]	60	28	46.2	3.73	
East Brother L. H				2.85	
Edmanton[e1]	54	17	34.4	10.66	14.0
Elcajon	86	30	53.4	2.21	
Elmdale	70	27	45.8	0.59	
Elsinore	89	28	53.2	3.04	
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Escondido	76	26	48.5	3.04	
Fallbrook	76	30	51.9	4.00	
Fernando	78	32	52.7	3.08	
Folsom[e1]	70	30	47.5	4.15	
Fordyce Dam				9.22	60.0
Fort Bragg				7.05	
Fort Ross	62	36	49.3	7.87	
Foster				3.01	
Georgetown	68	27	44.5	7.76	
Geyserville	64	27	45.6	2.91	
Gilroy (near)	72	25	48.0	1.25	
Glendora				2.55	
Greenville	61	13	35.2	7.49	2.5
Hanford	75	23	43.6	0.56	
Healdsburg	64	28	47.7	4.61	
Hollister	70	24	47.8	1.02	
Humboldt L. H				7.39	
Idylwild	73	12	42.0	2.60	9.0
Imperial	84	32	52.8	1.75	
Indio[e1]	73	28	51.5	0.80	
Iowa Hill[e1]	64	32	45.6	8.27	
Irvine	76	34	56.2	2.74	
Jackson	65	31	46.5	3.73	
Jolon				1.20	
Kennedy Gold Mine	62	24	40.9	4.13	
Kent	65	29	47.7	5.52	
Kernville				0.45	
King City	74	22	48.4	0.59	
Kono Tayee	57	31	44.6	2.47	
Laguna Valley				2.95	6.0
Lamesa				3.03	
Laporte[e1]	50	18	32.7	12.84	27.2
Legrande	70	28	46.2	1.14	
Lemoncove	75	29	48.1	1.23	
Lick Observatory	59	26	41.8	3.11	0.5
Lime Point L. H				1.44	
Livermore	72	26	48.3	0.87	
Lodi	68	27	45.8	1.52	
Los Banos	65	30	46.2	0.25	
Los Gatos	68	32	48.7	1.89	
Mammoth[e1]	73	34	54.2	0.61	
Manzana	65	26	42.6	1.78	6.0
Mare Island L. H				2.26	
Merced	69	29	44.4	0.36	
Mercury	66	30	51.4	5.51	
Mills College				3.73	
Milo				1.58	
Milton (near)	70	26	47.6	1.61	
Modesto[e1]	75	33	48.4	0.65	
Mohave[e1]	65	27	42.0	0.21	T.
Mokelumne Hill[e3]		31	42.8	3.57	
Monterio	70	30	47.2	3.00	
Monterey[e1]	63	31	51.4	1.17	
Mount St. Helena				8.54	
Napa	63	30	47.8	2.94	
Needles	70	30	48.8	0.55	
Nevada	72	22	43.1	7.65	
Newcastle	65	29	45.4	4.75	
Newhall[e1]	76	26	46.1	2.45	
Newman	67	26	45.4	0.49	
Niles	70	32	49.0	1.46	
North Bloomfield	66	22	41.6	8.05	T.
North Ontario	80	32	51.8	2.54	
North San Juan[e1]	64	27	46.7	9.66	
Oakland	65	34	49.0	3.14	
Ogilby[e1]	85	45	57.2	0.05	
Orland[e1]	64	32	48.5	1.62	
Palermo	61	26	45.8	4.62	
Paso Robles	66	18	42.4	0.96	
Peachland[e5]	61	30	48.2	5.31	
Piedras Blancas L. H				1.95	
Pigeon Point L. H				1.60	
Pilot Creek				7.94	5.0
Pine Crest	75	41	55.0	3.03	
Placerville	68	22	42.7	4.42	
Point Ano Nuevo L. H				2.25	
Point Arena L. H				5.19	
Point Bonita L. H				3.81	
Point Conception L. H				1.49	
Point Fermin L. H				4.10	
Point George L. H				8.56	
Point Hueneme L. H				2.68	
Point Lobos	59	39	50.0	2.10	
Point Loma L. H				2.78	
Point Montara L. H				5.52	
Point Pinos L. H				2.19	
Point Sur L. H				2.60	
Pomona (near)	77	31	50.4	2.39	
Porterville	75	28	47.7	0.79	
Poway	74	31	52.8	2.27	
Quincy	58	17	35.0	7.68	3.0
Ranch House				3.63	
Redding	58	28	45.4	6.24	T.
Redlands	78	33	51.5	1.50	
Reedley	75	29	47.2	0.88	
Represa	62	24	44.6	4.75	
Riovista	66	29	46.5	1.89	
Riverside	84	26	50.8	1.64	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Roe Island L. H.				2.18	
Rohnerville *5	65	26	46.2	6.87	
Rosewood	59	23	42.6	3.50	
Sacramento	68	30	46.8	3.59	
Salinas	70	22	48.8	1.39	
Salton *1	77	32	55.1	0.98	
San Bernardino	86	25	51.4	1.94	
San Jacinto	78	29	50.0	2.12	
San Jose	71	29	50.3	0.92	
San Leandro	64	31	47.2	3.25	
San Luis L. H.				1.00	
San Mateo *1	57	32	40.0	1.90	
San Miguel *1	68	22	45.8	0.34	
Santa Ana	70	35	55.4	2.48	
Santa Barbara	74	38	54.2	2.24	
Santa Barbara L. H				2.19	
Santa Clara	72	26	49.2	1.22	
Santa Cruz	70	28	49.6	2.23	
Santa Cruz L. H.				2.12	
Santa Maria	73	32	52.3	0.79	
Santa Monica	73	39	53.6	2.97	
Santa Rosa	63	25	46.6	4.43	
Sausalito				6.25	
Shasta	58	30	44.6	7.37	
Sierra Madre	76	40	53.8	3.26	
Sonoma				2.91	
Stockton	66	31	45.1	1.26	
Storey	70	27	45.0	1.67	
Summerdale	65	15	39.9	3.95	7.0
Summit	41	12	28.1	4.60	46.0
Susanville	60	7	32.5	3.04	3.0
Tehama *1	68	34	50.4	2.79	
Tejon Ranch	75	30	49.2	2.06	
Trimmer				1.41	
Trinidad L. H				9.31	
Truckee *1	50	— 4	29.2	3.60	36.0
Tulare *b*				0.49	
Tulare *c*	80	26	48.3	0.50	
Tustin	69	40	56.2	2.82	
Ukiah	59	25	45.0	5.71	
Upperlake	65	21	42.7	3.70	
Upper Mattole *1	60	31	45.9	15.98	
Vacaville *1	63	26	47.5	2.00	
Visalia	75	27	46.0	0.71	
Volcano Springs *5	80	32	59.4	0.95	
Wasco	75	25	45.3	0.36	
Westpoint				5.02	
West Saticoy				1.10	
Wheatland	65	29	45.4	3.81	
Williams *1	64	35	50.3	1.07	
Willits	60	26	44.2	9.66	T.
Willow	64	27	45.7	0.96	
Yerba Buena L. H.				2.10	
Yuba City *5	68	30	48.6	2.77	
Zenia	58	24	41.8	11.95	3.0
Colorado.					
Alford	62	2	30.4	0.55	8.0
Ashcroft	50	—14	19.7	1.42	17.0
Blaine	74	— 5	31.8	0.61	9.2
Boulder	68	8	36.5	1.34	17.0
Boxelder				1.51	17.0
Breckenridge	45	—23	14.4	1.08	20.2
Buenavista				0.85	13.0
Canyon	67	4	37.4	0.57	6.0
Castlerock	66	— 8	31.0	1.36	13.0
Cedaredge	65	— 4	27.4	1.15	10.1
Cheesman	63	—10	30.6	0.63	9.1
Cheyenne Wells	65	— 1	27.9	0.52	7.2
Clearview	54	— 8	25.9	1.76	23.0
Colorado Springs	64	0	32.6	0.32	6.0
Collbran	49	— 9	22.4	0.86	13.8
Delta	56	—20	20.7	0.94	13.0
Durango	59	8	26.4	2.69	26.0
Fort Collins	58	—18	27.0	0.77	10.6
Fort Morgan	50	—12	21.6	0.51	7.0
Fox	62	— 8	25.5	1.55	14.5
Fruita	54	— 6	23.2	0.17	1.6
Garnett	49	—32	11.6	1.03	6.5
Gilman				2.37	33.0
Gleneyre	67	— 3	32.5	0.77	8.2
Greeley	50	—19	24.0	0.67	7.0
Grover				1.00	12.0
Gunnison	46	—35	11.8	0.78	14.3
Hamps	67	— 2	27.2	0.98	13.5
Hoehne				0.52	6.8
Holyoke (near)	58	— 4	22.8	0.35	7.0
Husted	67	—15	30.8	0.51	9.0
Lake Moraine				0.82	11.4
Lamar	74	— 3	31.4	0.40	5.5
Laporte				0.93	14.0
Las Animas	75	— 7	30.0	0.29	4.0
Lay	53	—24	18.4	0.72	11.0
Leadville (near)				0.77	13.3
Leroy	52	3	25.0	0.99	13.0
Longs Peak	52	— 2	26.2	0.78	12.5
Mancos	59	—12	27.3	1.69	20.3
Marshall Pass				2.04	32.0
Meeker	59	—19	22.2	1.15	15.4
Colorado—Cont'd.					
Montrose				0.84	12.9
Moraine	53	0	27.4	0.73	11.5
Pagoda	55	—16	22.7	2.38	25.5
Parachute	52	— 6	24.0	0.46	6.3
Rangely	53	—25	16.8	0.97	11.8
Rockyford	71	— 7	30.3	0.33	4.5
Rogers Mesa	52	— 7	22.8	0.80	7.6
Ruby				5.11	7.9
Russell	49	—28	17.0	0.91	12.0
Saguache	46	—20	15.3	0.42	7.0
Salida	61	—14	30.0	0.40	6.0
San Luis	55	—28	19.2	0.78	19.0
Santa Clara	58	— 4	30.0	1.10	19.0
Silt	56	0	25.2	0.59	4.5
Sugarloaf	60	— 2	30.8	1.34	21.0
Telluride *c*	47	—11	21.5	4.03	.....
Trinidad	66	3	36.0	0.31	8.0
Twinlakes				0.30	6.2
Vilas				0.27	4.0
Wagon Wheel	49	—31	12.0	0.95	16.0
Wallet				0.87	13.0
Waterdale	67	— 2	32.0	0.83	10.0
Westcliffe	55	— 8	28.6	1.46	22.4
Whitepine	40	—19	14.7	1.78	24.2
Wray	65	— 2	26.5	0.59	6.5
Yuma				0.73	11.5
Connecticut.					
Bridgeport	53	— 4	29.6	7.64	19.0
Canton	50	—13	22.8	6.95	31.0
Colchester	55	—10	27.8	8.06	29.5
Falls Village				6.48	29.2
Gaylordsville				7.16	.....
Hartford *a*	55	— 8	27.7	7.10	24.5
Hartford *b*	49	— 8	25.9	8.26	22.5
Hawleyville	52	—11	26.6	5.44	33.0
Lake Konomoc				6.53	
New London	55	— 6	27.8	5.67	14.5
North Grosvenor Dale	54	—11	24.8	7.02	.....
Norwalk	53	— 7	27.4	7.02	15.5
Southington	50	—13	25.9	8.55	21.5
South Manchester				5.72	24.0
Storrs	58	— 9	25.6	5.86	16.1
Voluntown	57	—10	28.4	6.38	17.1
Wallingford				8.60	19.0
Waterbury	52	—12	26.8	6.92	32.0
West Cornwall	48	—15	22.8	7.68	42.5
West Simsbury				7.32	35.0
Delaware.					
Delaware City				5.26	5.0
Milford	64	15	37.8	5.52	2.0
Millsboro	65	13	36.0	7.42	1.5
Newark	58	9	31.0	7.35	5.0
Seaford	63	17	37.0	4.79	2.0
District of Columbia.					
Distributing Reservoir *5	54	20	35.2	5.50	.....
Receiving Reservoir *5	52	20	34.6	6.39	.....
West Washington	60	13	33.4	5.72	1.8
Florida.					
Archer	83	20	57.6	9.80	
Avon Park	92	30	63.6	2.44	
Bartow	87	28	65.3	1.52	
Bonifay	78	20	53.8	2.25	
Brooksville	84	25	61.2	4.25	
Carrabelle	79	33	57.9	6.95	
Clermont	89	31	63.8	1.45	
De Funiak Springs	79	17	52.6	2.98	
Deland	88	25	60.5	.....	
Eustis	84	27	62.6	1.96	
Federal Point	82	29	59.4	6.00	
Fernandina	78	25	56.7	7.28	
Flamingo	85	39	70.4	1.13	
Fort George *1	80	24	56.8	.....	
Fort Meade	88	23	61.7	2.68	
Fort Myers	82	36	63.8	2.93	
Fort Pierce	88	34	65.6	2.26	
Gainesville	84	25	59.5	7.31	
Grasmere	86	27	60.2	.....	
Huntington	85	25	60.5	2.55	
Hypoluxo	87	39	68.8	1.00	
Inverness	82	21	58.3	1.36	
Jasper	78	22	55.0	6.26	
Johnstown	82	21	57.8	4.90	
Kissimmee	88	29	63.2	0.96	
Lake City	82	22	57.6	4.70	
Macclenny	89	21	57.6	5.30	
Malabar	86	31	64.5	1.10	
Manatee	85	31	62.6	1.68	
Marco	84	38	67.2	3.05	
Marianna	76	20	52.4	1.72	
Merritt Island	84	33	64.4	1.74	
Miami	89	37	69.8	1.86	
Micanopy d	84	24	57.9	9.57	
Molino	77	22	52.7	5.54	
Nocatee	86	29	64.0	2.26	
Ocala	84	21	59.4	2.43	
Orlando	86	28	62.4	1.35	
Pinemount	81	20	56.0	6.20	
Rideout	85	27	57.8	6.21	
Florida—Cont'd.					
Rockwell	83	22	62.0	1.85	
St. Andrews	76	23	53.4	2.54	
St. Augustine	85	25	59.2	5.08	
St. Leo	85	26	61.3	1.46	
Stephensville	82	21	55.0	5.52	
Sumner	83	23	58.4	14.93	
Switzerland	84	26	56.0	7.63	
Tallahassee	80	22	55.6	5.39	
Tarpon Springs	85	28	61.0	3.42	
Waukeenah	76	20	53.4	7.33	
Wausau	82	18	54.2	2.47	
Wewahitchka				3.17	
Georgia.					
Adairsville	68	16	42.4	5.47	T.
Albany	71	27	52.3	5.21	
Allapaha	77	19	52.4	5.52	
Alpharetta	69	13	42.0	.....	
Americus	72	14	49.2	2.79	
Athens	70	16	43.7	4.42	
Bainbridge	76	18	52.0	4.44	
Blakely	74	18	49.8	2.17	
Bowersville	78	14	42.6	4.27	
Brent	72	14	45.2	6.70	
Butler				3.85	
Camak	70	16	46.2	3.17	
Canton				5.86	
Carlton				5.42	
Clayton	67	13	41.3	8.09	0.5
Columbus	73	18	48.8	4.60	
Coney	74	16	50.6	2.70	
Covington	70	14	44.4	3.50	
Dahlonega	67	14	41.6	8.00	T.
Diamond	64	12	41.6	6.82	1.0
Douglas	80	18	54.0	6.50	
Dublin				2.77	
Dudley	72	12	49.7	2.71	
Eastman	73	17	49.4	2.91	
Elberton	67	15	43.9	4.71	
Experiment	69	14	44.5	2.80	
Fitzgerald	77	16	50.5	3.90	
Fleming	78	12	51.8	4.87	
Fort Gaines	77	18	51.0	3.14	
Gainesville	64	14	42.0	6.15	
Gillsville	69	14	44.2	4.48	
Greensboro	69	14	44.2	5.15	
Griffin	69	15	44.8	3.11	
Harrison	71	17	49.6	2.66	
Hawkinsville	76	17	49.4	3.52	
Hephzibah	70	17	47.3	2.38	
Jesup	78	18	53.1	4.16	
Lost Mountain	70	14	44.0	5.15	
Louisville	72	17	47.8	2.81	
Lumpkin	74	13	49.8	3.16	
Marshallville	73	16	49.4	2.66	T.
Mauzy	81	18	53.4	2.83	
Milledgeville	70	18	45.8	3.08	
Millen	78	14	50.8	3.38	
Monticello	70	15	46.0	5.02	
Morgan	79	16	49.0	2.20	
Naylor	80	20	54.0	5.47	
Newnan	67	14	43.0	5.59	
Oakdale				6.25	
Point Peter	69	13	43.8	4.57	
Poulan	77	15	50.8	4.11	
Putnam	72	15	48.0	3.65	
Quitman	77	20	53.4	11.34	
Ramsey	68	15	43.4	5.38	
Resaca				5.65	
Rome	69	17	42.0	5.47	T.
St. Marys	81	21	55.6	7.34	
Statesboro	74	19	51.4	4.09	
Talbotton	71	16	47.4	4.54	
Tallapoosa	70	13	42.0	4.99	
Thomasville	78	20	53.7	6.45	
Toccoa	68	16	42.9	6.10	
Valona	79	19	55.8	3.20	
Vidalia	74	18	50.8	2.92	
Washington	70	18	44.7	3.60	
Waverly	83	19	55.0	3.10	
Waycross				3.00	
Waynesboro	77	18	48.7	4.77	
Westpoint	73	13	45.6	5.44	
Woodbury	70	14	44.4	3.19	
Idaho.					
Albion	58	4	30.6	2.31	4.5
American Falls	53	5	27.9	1.22	.....
Blackfoot	52	3	26.6	0.10	1.0
Blue Lakes	56	13	34.3	1.60	3.5
Burnside	40	— 7	20.4	1.30	13.0
Cambridge	45	—14	21.6	4.19	.....
Forney	53	— 9	24.3	3.20	29.5
Garnet	53	13	34.2	1.00	4.0
Grangeville	58	13	32.6	2.21	15.1
Hailey	65	— 5	21.7	2.75	.....
Lakeview	48	15	31.5	5.71	16.0
Lost River	42	—13	16.8	0.40	4.0
Moscow	50	6	29.0	3.73	21.6
Murray	42	0	26.8	7.10	53.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Idaho—Cont'd.	°	°	°	*Ins.*	*Ins.*
Oakley	52	7	30.6	0.75	2.0
Ola				2.87	12.9
Paris	47	−23	17.2	1.52	15.2
Payette	50	8	32.0	1.89	16.2
Pollock	58	17	36.5	1.31	5.3
Porthill	42	10	26.4	3.54	40.0
Priest River	41	13	27.8	4.39	25.5
Riddle	54	− 4	25.6	1.40	11.0
St. Maries	44	6	31.9	4.95	21.2
Silver City	48	3	26.6	4.90	31.0
Soldier	42	−25	14.8	2.48	24.2
Thunder Mountain	44	0	21.8	4.98	41.7
Vernon	60	− 8	25.0		
Weston	51	5	27.4	1.28	5.0
Illinois.					
Albion	57	5	32.6	4.99	1.0
Aledo	56	− 7	24.4	1.96	6.2
Alexander	55	0	28.6	2.45	1.2
Antioch	45	− 5	23.2	0.70	4.2
Ashton	50	−12	22.2	1.69	9.0
Astoria	53	− 1	26.9	2.77	9.5
Aurora	51	− 6	24.6	1.71	4.3
Benton	65	9	35.2	5.55	0.8
Bloomington	50	− 2	27.2	2.24	3.3
Cambridge	52	− 6	24.1	2.05	15.5
Carlinville	54	1	30.6	3.39	1.0
Carrollton	53	1	30.4	3.14	
Centralia	59	4	32.8	3.88	2.5
Charleston	50	2	30.0	3.94	2.5
Chester				4.08	0.0
Cisne	62°	4°	32.8°	4.11	2.0
Coatsburg	53	− 5	27.0	2.80	4.0
Cobden	64	5	36.4	6.36	T.
Decatur	54	− 1	28.6	3.83	3.9
Dixon	50	− 9	21.8	2.13	13.9
Dwight	48	− 2	26.4	1.49	5.2
Effingham	56	3	32.8	3.40	3.0
Equality	58	8	35.8	5.17	0.2
Fandon	54	− 3	27.4	2.39	6.0
Friendgrove	62	6	33.2	5.13	1.0
Galva	54	− 7	24.4	1.64	8.0
Grafton				4.48	1.5
Greenville	59	2	31.2	3.92	1.8
Griggsville	56	− 2	28.8	2.65	
Halfway	64	6	34.8	4.75	1.5
Halliday	64	5	34.9	4.79	0.0
Henry	53	− 9	26.2	1.88	4.0
Hillsboro	53	1	30.4	4.00	1.5
Hoopeston	45	− 2	25.4	2.60	8.5
Joliet	50	− 3	24.9	1.68	4.7
Kishwaukee	48	−11	21.4	1.87	6.5
Knoxville		− 6	25.8	2.07	6.3
Lagrange	50	− 4	25.7	2.31	2.8
Laharpe	52	− 2	25.8	2.04	6.5
Lanark	49	−11	21.8	2.78	17.1
Loami				1.86	0.5
McLeansboro	63	5	34.4	5.27	1.0
Martinton	51	− 5	26.0	2.91	6.5
Mascoutah	54	4	32.0	3.75	1.2
Mattoon	54	2	32.8	2.77	2.9
Minonk	51	− 6	25.6	1.79	5.0
Monmouth	53	− 6	23.3	2.56	9.3
Monticello	53	1	27.4	1.01	2.5
Morrison	50	−13	23.4	2.45	10.9
Morrisonville	51	1	29.8	3.02	1.0
Mount Carmel				5.82	2.0
Mount Pulaski	53	0	27.8	2.21	4.5
Mount Vernon	60	4	33.8	4.91	2.0
New Burnside	66	6	35.6	6.03	T.
Olney	65	5	32.8	4.01	3.4
Ottawa	52	− 4	27.7	2.01	3.8
Palestine	58	0	29.7	3.78	5.0
Pana	50	1	29.8	3.68	1.0
Paris	49	4	28.4	3.89	
Peoria *a*				1.67	4.7
Peoria *b*	54	− 1	28.6	1.54	0.6
Philo	50	1	27.6	3.12	4.0
Plumhill	59	5	33.0	4.10	2.5
Rantoul	51	− 1	27.3	2.96	4.3
Raum	64	10	35.9	7.16	0.3
Riley	46	− 8	22.6	2.35	9.1
Robinson	58	1	31.2	4.10	3.5
Rushville	55	− 2	27.7	2.67	6.7
St. Charles	50	− 5	25.0	1.84	5.0
St. John	63	5	34.3	4.54	1.2
Shobonier	55	3	32.4	3.06	3.5
Streator	52	− 5	26.4	1.74	3.3
Sullivan	53	0	29.1	3.09	1.0
Sycamore	50	− 8	23.2	2.02	9.0
Tilden	61	4	33.8	4.33	3.0
Tiskilwa	50	− 9	23.8	2.12	7.0
Tuscola	51	1	27.9	4.24	4.3
Urbana	51	0	26.8	2.94	3.5
Walnut	52°	− 9°	24.5°	1.81	6.5
Winchester	59	1	29.1	3.46	2.0
Winnebago	46	−11	21.7	2.10	9.0
Yorkville	50	− 8	24.9	1.80	1.8
Zion	43	− 9	19.2	2.49	10.0

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Indiana.	°	°	°	*Ins.*	*Ins.*
Anderson	51	3	28.6	3.90	6.0
Angola	44	1	25.1	4.67	20.0
Auburn	45f	− 3f	24.4f	2.85	
Avoca	59c	− 7c	33.7c	4.66	2.9
Bloomington	56	4	30.8	5.28	6.0
Bluffton	49	− 1	26.4	2.70	6.5
Butlerville	55	− 2	31.7	5.02	3.9
Cambridge City	52	− 6	27.8	3.56	3.6
Columbus	56	− 7	32.0	3.90	2.8
Connersville	53	− 4	29.3	3.62	2.5
Crawfordsville	50	3	29.8	4.10	4.5
Delphi	50	2	26.2	3.37	9.2
Edwardsville	58	12	36.1	7.20	2.5
Elkhart	49	1	26.0	2.03	8.6
Farmland	57	6	29.4	3.71	9.0
Franklin*1	55	6	31.9	3.91	
Greencastle	51	3	29.4	3.98	3.4
Greensburg	54	− 1	30.8	4.25	3.5
Hammond	50	− 1	24.0	2.08	9.0
Hector	48	2	26.8	4.00	12.0
Holland	61	5	35.0	7.18	1.5
Huntington	49	2	26.0	3.52	12.5
Jeffersonville	60	8	35.4	5.54	1.0
Kokomo	48	4	27.5	2.68	8.4
Lafayette	49	2	27.4	3.47	9.8
Laporte	51	3	26.5	3.09	23.8
Logansport	43	2	26.0	3.12	
Madison *a*	62	2	34.9	5.64	3.0
Madison *b*				5.34	5.5
Marengo	61	1	34.5	6.75	3.0
Marion	50	4	27.5	3.12	10.5
Markle	49	0	27.0	3.75	14.5
Mauzy	53	− 1	28.9	4.02	6.0
Moores Hill	59	6	32.0	4.87	4.0
Mount Vernon	62	7	34.4	6.02	0.8
Northfield	50	− 8	27.6	3.01	6.0
Paoli	58	3	33.4	5.49	2.5
Prairie Creek	55	1	31.0	3.38	
Princeton	60	6	34.4	5.53	2.5
Rensselaer	47	− 2	26.4	2.79	16.0
Richmond	55	− 4	29.8	3.77	2.5
Rockville	51	3	29.0	3.11	3.0
Salem	62	− 1	33.6	7.25	2.0
Scottsburg	60	2	34.7	5.19	2.0
Seymour	57	− 2	31.5	4.90	4.5
Shelbyville	59d	9c	33.4c	3.62	
South Bend	50	0	26.2	3.31	19.5
Syracuse	46	0	25.4	3.17	23.5
Terre Haute	52	6	31.4	3.79	2.5
Topeka	44	− 2	25.1	1.32	4.0
Valparaiso	48	− 4	24.9	1.96	
Veedersburg	59f	2f	30.6f	3.46	
Vevay	60	5	35.4	6.35	9.0
Vincennes	60	6	32.0	4.55	3.0
Washington	60	7	32.4	4.81	1.5
Worthington	58	− 2	31.6	4.57	3.2
Indian Territory.					
Ardmore	62	17	39.0	2.41	
Chickasha	71	13	37.8	1.74	1.2
Claremore	61	12	38.2	2.60	1.0
Durant	69	20	40.2	3.36	
Fairland	65	8	36.3	2.76	1.0
Goodwater	72	21	44.4	4.86	6.0
Hartshorne	66	19	40.4	2.95	3.5
Healdton	73	16	40.6	3.94	
Holdenville				2.41	T.
Marlow	72	13	38.5	1.39	1.5
Muskogee	68	14	38.2	3.25	2.0
Pauls Valley	69	14	38.2	2.25	2.0
Ravia	74	19	41.8	2.72	3.2
South McAlester				4.72	3.0
Tahlequah	65	14	39.1	4.04	2.5
Tulsa				3.43	3.0
Wagoner				4.20	
Webbers Falls				4.12	0.5
Iowa.					
Afton	48	− 9	21.6	2.30	15.0
Albia	50	− 5	23.0	1.92	16.0
Algona	47	−16	18.0	2.45	14.5
Allerton	53	− 7	23.4	1.48	7.5
Alta	44	−17	14.6	1.97	15.1
Amana	46	− 7	22.0	1.97	11.8
Ames	48	− 7	20.6	1.87	11.5
Atlantic	48	−11	19.6	2.66	14.0
Audubon	48	−12	21.0	1.75	16.7
Baxter	48	−10	20.8	1.95	9.0
Bedford	52	− 9	22.1	2.13	9.2
Belleplaine	43	− 9	20.4	2.40	16.0
Bonaparte	54	− 3	24.4	1.47	8.0
Britt	44	−16	17.0	1.93	12.1
Buckingham				1.40	13.2
Burlington	56	− 3	25.8	2.13	
Carroll	51	−14	19.3	2.58	17.0
Cedarrapids	47	− 7	22.6	1.96	8.8
Charlton	52	− 7	22.8	1.91	16.4
Charles City	40	−17	17.2	2.30	15.5
Chester	49	−16	15.1	4.37	10.2
Clarinda	53	− 8	22.0	2.53	12.2

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Clearlake	42	−16	16.3	1.95	9.5
Clinton	48	−12	22.8	2.09	8.5
College Springs	52	− 7	22.6	2.44	15.6
Columbus Junction	48	− 5	22.8	2.16	13.8
Corning	49	−10	20.6	3.10	19.8
Council Bluffs	51	−13	21.0	1.91	
Cumberland				1.80	14.0
Danville				1.10	
Decorah	43	−12	18.6	3.00	11.2
Delaware	40	−15	18.2	2.25	14.3
Denison	49	−14	18.2	1.40	9.0
De Soto e	50	− 7	22.5	2.79	12.3
Dows	44	−13	17.2	1.70	16.0
Earlham	49	−10	19.4	2.59	16.8
Eldon	53	− 6	23.6	1.45	1.1
Elkader	47	−11	20.4	2.50	11.0
Estherville	46	−20	14.6	1.80	
Forest City	43	−16	17.4	2.80	14.0
Fort Madison				3.20	9.0
Galva				1.90	8.5
Gilman				1.60	10.0
Grand Meadow	42	−14	18.2	2.44	10.7
Greene	45	−12	19.0	2.30	19.1
Greenfield	47	−12	20.2	1.98	18.0
Grinnell	43	− 8	20.6	2.26	13.8
Grinnell (near)	46	−10	20.6	2.50	12.5
Grundy Center	45	−11	19.0	2.05	12.5
Guthrie Center	44	−11	20.2	2.27	19.6
Hampton	47	−12	18.8	2.42	16.4
Hanlontown	46	−15	16.6		
Harlan	48	−12	18.6	2.69	14.2
Hopeville				1.69	
Humboldt	46	−15c	17.5	1.57	15.7
Idagrove	46	−14	18.3	3.10	
Independence	41	−11	18.2	1.72	12.6
Indianola	50c	− 8c	21.8c		
Iowa City	51	− 7	22.2	2.21	12.0
Iowa Falls	43	−11	17.9	2.11	16.0
Jefferson				2.32	11.8
Keosauqua	51	− 3	24.8	2.21	12.5
Lacona				3.60	20.7
Lansing	45	−12	20.4	2.12	
Larrabee	47	−77	16.6	2.17	11.8
Leclaire				1.38	6.3
Lemars	45	−13	18.1	3.15	11.0
Lenox	49	−12	20.4	1.69	8.8
Leon	50	− 7	22.8	2.03	12.9
Logan	44	− 9	20.2	2.14	12.0
Maple Valley				1.97	12.0
Maquoketa	45	−13	19.6	2.35	9.0
Marshalltown	47	− 8	21.4		9.4
Monticello	50	−14	19.6	2.46	14.0
Mountayr	51	− 9	21.1	2.57	14.0
Mount Pleasant	49	− 8	22.4	1.08	10.8
Mount Vernon	46	−11	21.0	2.40	15.6
New Hampton	41c	−13c	18.0f	2.20	12.0
Newton	47	−10	20.5	2.13	15.5
Northwood	44	−13	17.8	2.68	18.0
Odebolt	46	−14	18.8	2.50	14.5
Ogden	52	−17c	23.3c	1.63	7.4
Olin	44	−13	21.2	2.87	
Onawa	46	− 9	19.9	2.85	20.2
Osage	41	−13	17.4	2.41	16.1
Osceola	51	− 9	22.5	2.34	
Oskaloosa	52	− 6	22.6	1.53	15.25
Ottumwa	52	− 2	25.6	0.67	6.7
Ovid	47	− 7	22.6	2.39	13.5
Pacific Junction	49	− 7	20.9	2.55	12.7
Perry	50	−10	20.6	2.54	14.2
Plover	45	−17c	17.4	1.10	11.0
Redoak	56	− 6	25.2	2.52	15.5
Ridgeway	43	−13	20.6	5.51	19.5
Rockford				1.53	11.0
Rockwell City	46	−12	19.5	3.00	9.0
Sac City	43	−15	17.2	2.16	14.0
St. Charles	53	− 8	22.8	2.75	18.3
Scranton	46	−11	19.8	2.50	
Sheldon	46	−16	15.3	1.12	6.5
Sibley	48c	−16c	15.8c	1.85	11.0
Sigourney	51	− 6	23.0	2.25	12.0
Sioux Center	46	−17	15.6	2.60	11.5
Spirit Lake	52	−20	16.2	1.46	9.5
Stockport				2.23	12.0
Storm Lake	42	−18	16.7	1.92	14.0
Thurman	48	− 7	21.0	4.31	
Tipton	50	−10	22.6	1.70	13.5
Toledo	46	− 8	20.6	1.40	11.5
Villisca	45	−10	21.8	2.80	
Vinton *1	45	− 9	21.1	1.35	13.5
Wapello	47	− 2	25.1	1.99	11.5
Washington	50	− 8	21.0	2.47	16.5
Washta				3.10	12.5
Waterloo	45	−11	19.6	1.94	9.8
Waukee				2.36	16.5
Waverly	43	−13	19.0	2.10	11.2
Westbend	46	−15	17.5	2.34	13.5
Westbranch				1.63	10.0
Wilton Junction	46	−10	22.1	2.03	14.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Winterset	56	— 9	21.0	2.09	12.9
Woodburn	.....	.....	.....	2.40	14.0
Kansas.					
Abilene	.....	.....	.....	0.40	4.0
Achilles	73	—10	23.8	0.86	8.6
Altoona	60	— 8	25.3	0.63	5.5
Anthony	.....	.....	.....	0.72	4.0
Atchison	58	— 2	27.0	1.60	7.2
Burlington	58	3	30.6	1.63	3.0
Chanute	59	4	31.2	1.71	1.0
Clay Center	59	— 7	25.6	1.09	7.7
Colby	69	— 5	24.2	0.82	9.1
Columbus	62	5	33.8	2.57	1.1
Cottonwood	58	— 1	30.0	1.17	4.4
Delphos	58	— 8	24.1	0.88	5.5
Dresden	74	— 2	25.6	0.83	8.0
Ellinwood	59	— 5	27.8	1.09	9.0
Englewood	66	— 1	30.8	0.60	4.5
Eureka	.....	.....	.....	1.51	.....
Eureka Ranch	65	—11	25.3	0.98	10.0
Fall River	62	5	32.6	0.81	1.0
Farnsworth	74	— 5	26.2	0.63	6.7
Forsha	61	— 3	29.8	0.65	5.0
Fort Leavenworth	57	— 1	28.2	1.05	4.0
Fort Scott	61	3	32.8	1.56	T.
Frankfort	52	— 2	24.5	1.73	7.5
Fredonia	60	4	33.3	2.32	1.0
Garden City	69	—12	27.8	1.00	8.7
Gove	69	5	25.4	1.70	.....
Grenola	65	5	32.1	1.37	1.2
Hanover	50	0	23.5	0.85	8.0
Harrison	56	— 5	22.6	0.66	4.9
Hays	63	— 6	25.1	1.35	13.5
Holton	58	— 3	26.6	1.53	6.5
Horton	57	— 3	25.5	1.83	7.5
Hoxie	71	— 4	24.9	1.05	10.5
Hutchinson	61	— 4	28.6	0.83	7.0
Independence	65	6	33.4	2.09	0.5
Jetmore	61	— 5	28.3	.....	
La Crosse	61	— 8	26.3	0.65	6.5
Lakin	65	— 7	28.0	0.40	5.0
Lawrence	56	0	28.2	1.83	6.2
Lebanon	54	— 3	22.4	0.90	9.0
Lebo	57	2	29.7	1.60	3.0
Leoti	72	— 5	29.0	0.42	4.2
Little River	59	— 4	27.2	0.65	6.5
Macksville	59	— 7	26.0	0.69	5.0
McPherson	77	0	27.6	0.90	5.5
Madison	59	— 4	31.2	1.60	4.0
Manhattan	62	2	28.3	1.18	8.0
Meade	60	— 1	28.8	0.50	5.0
Medicine Lodge	65	1	31.9	0.72	4.5
Minneapolis	58	— 7	24.6	0.75	7.5
Moran	58	2	32.8	1.89	1.0
Mounthope [1]	55	8	30.6	0.92	5.0
Ness City	64	— 2	28.7	0.61	6.4
Newton	58	3	29.9	1.20	4.0
Norwich	62	7	31.0	0.71	2.0
Oberlin	.....	.....	.....	1.35	10.5
Olathe	54	0	29.2	1.10	3.0
Oswego	62	5	34.3	2.21	T.
Ottawa	58	0	29.2	1.59	4.0
Paola	57[d]	10[d]	31.4[d]	1.45	1.8
Phillippsburg	.....	.....	.....	1.36	11.0
Pittsburg	.....	.....	.....	2.17	0.7
Pratt	62	1	28.8	0.55	6.0
Republic	56	—10	23.7	0.60	6.0
Rome	69	10	32.7	1.12	2.0
Salina	58	—11	26.3	0.84	5.0
Sedan	66	6	34.0	2.22	T.
Seneca	55	— 4	25.2	1.70	8.2
Toronto	60	2	28.8	2.35	2.0
Ulysses	72[g]	—10[g]	27.6[g]	0.70	7.0
Valley Falls	57	— 1	26.8	1.19	5.9
Viroqua	73	— 2	31.0	0.10	1.0
Wakeeney	.....	.....	.....	0.83	8.3
Wallace	.....	.....	.....	0.50	5.0
Walnut	61[e]	4[e]	32.5[e]	2.48	T.
Wamego [1]	58	1	27.2	1.55	9.0
Winfield	61	9	31.8	1.28	1.0
Yates Center	.....	.....	.....	2.07	2.0
Kentucky.					
Alpha	61	15	41.0	7.56	2.0
Anchorage	63	2	34.1	5.44	3.0
Beattyville	.....	.....	.....	6.69	3.4
Berea	63	9	36.2	7.26	6.0
Blandville	63	8	35.8	9.78	T.
Bowling Green	68	10	39.0	9.24	
Burnside	64	14	37.6	7.72	2.1
Cadiz	63	10	36.4	9.60	
Carrollton	58	5	34.0	5.52	7.3
Catlettsburg	64	12	37.0	6.95	1.0
Earlington	65	8	36.3	9.40	0.2
Edmonton	64	11	38.2	9.82	3.2
Eubank	63	12	36.4	7.52	3.0
Falmouth	.....	.....	.....	6.25	8.0
Fords Ferry	65	6	37.2	8.51	.....
Frankfort	63	10	36.1	6.90	0.6

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kentucky—Cont'd.	°	°	°	*Ins.*	*Ins.*
Franklin	65	10	38.4	7.75	T.
Greensburg	62	12	37.3	8.82	0.2
Henderson	63	8	35.6	6.46	0.2
Highbridge	63	11	37.6	8.50	1.4
Hopkinsville	67	8	37.9	11.38	0.2
Irvington	69	8	37.5	5.92	1.5
Jackson	71	13	40.8	6.17	4.5
Leitchfield	64	8	35.5	11.97	1.6
Loretto	64	9	35.8	7.41	0.1
Manchester	62	12	37.3	7.10	1.5
Marrowbone	64	12	36.4	7.82	T.
Mayfield	70	8	37.6	8.12	3.1
Maysville	67	11	36.3	6.51	3.1
Middlesboro	63	3	37.6	5.10	
Mount Sterling	60	10	35.4	8.97	5.0
Owensboro	64	9	37.4	5.91	1.0
Owenton	58	6	34.2	7.42	1.2
Paducah *a*	.....	.....	.....	9.20	T.
Paducah *b*	68	8	39.2	9.53	T.
Pikeville	70	14	39.6	4.07	1.5
Princeton	64	5	36.2	9.08	1.0
St. John	63	12	35.8	7.19	0.1
Scott	59	— 3	32.8	5.14	7.5
Shelby City	61	6	35.8	9.60	3.0
Shelbyville	67	6	34.4	5.84	4.0
Taylorsville	63	9	36.0	6.55	0.5
Warfield	.....	10[c]	.....	4.20	4.0
Williamsburg	72	13	40.5	4.02	1.0
Williamstown	60	9	34.0	5.67	7.0
Louisiana.					
Abbeville	80	27	52.8	5.45	
Alexandria	78	25	48.6	4.37	
Amite	73	23	49.3	7.10	
Baton Rouge	75	24	50.0	6.76	
Burnside	76	26	55.0	6.24	
Calhoun	72	19	45.2	4.17	1.3
Cameron	70	31	53.5	4.14	
Cheneyville	75	26	49.0	5.04	T.
Clinton	73	24	51.6	6.44	
Collinston	75	23	46.2	5.39	1.3
Covington	74	25	51.8	6.75	
Donaldsonville	82	27	54.6	4.20	
Emilie	75	26	51.6	6.18	
Farmerville	71	21	42.2	3.94	4.0
Franklin	79	30	53.5	5.59	
Grand Coteau	78	26	52.2	5.68	
Hammond	74	24	52.0	5.69	
Houma	78	29	53.2	7.28	
Jeanerette	80	31	55.4	2.37	
Jennings	78	27	51.6	4.42	
Lafayette	78	27	51.9	5.02	
Lake Charles	77	30	53.0	3.39	
Lake Providence	78	18	48.2	4.52	
Lakeside	79	31	53.2	3.20	
Lawrence	80	31	53.8	8.13	
Libertyhill	76	22	48.4	3.45	4.0
Mansfield	74	24	48.9	4.39	1.0
Melville	79	24	50.4	8.00	
Minden	71	24	47.5	4.15	0.5
Monroe	74	23	47.6	3.44	1.0
New Iberia	79	29	54.4	5.60	
Opelousas	79	26	51.0	5.51	
Oxford	76	24	48.3	2.10	0.3
Plain Dealing	71	22	46.1	5.30	2.8
Port Eads	78	40	58.4	6.07	
Rayne	75	30	54.8	6.80	
Reserve	78	29	53.7	6.07	
Robeline	75	22	48.3	2.70	T.
Ruston	73	18	46.0	4.15	3.0
Schriever	80	28	53.2	6.77	
Sugar Experiment Station	80	29	53.3	6.83	
Sugartown	75	30	54.8	4.22	
Venice	80	34	55.8	6.84	
Wallace	78	28	53.6	4.59	
Maine.					
Bar Harbor	52	—15	23.2	7.12	28.0
Belfast	52	—17	19.6	4.90	17.5
Carmel [1]	52	—18	17.4	2.45	9.0
Cornish	46	—17	21.2	7.06	34.2
Danforth	.....	.....	.....	3.71	16.8
Fairfield	49	—15	18.4	4.68	21.0
Farmington	48	—18	17.6	4.31	31.5
Gardiner	52	—20	18.8	5.35	18.0
Houlton	52	—21	21.0	4.62	22.0
Kineo	30	—29[e]	11.4	2.01	16.0
Lewiston	52	—14	19.4	5.26	26.0
Mattawamkeag	.....	.....	.....	4.88	16.0
Mayfield	45	—19	17.1	4.12	22.0
Millinocket	.....	.....	.....	5.23	29.0
North Bridgton	50	—16	20.9	6.27	35.0
Orono	53	—20	17.0	4.77	24.5
Patten	47	—19	14.8	2.20	10.0
Rumford Falls	46	—19	17.2	4.60	31.5
Solon	.....	.....	.....	3.51	.....
The Forks	.....	.....	.....	3.10	23.5
Vanburen	43	—30	10.3	2.75	20.4
Vanceboro	50	—10	25.8	2.70	18.0
Winslow	48	—19[e]	15.6	4.25	25.2

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Maryland.	°	°	°	*Ins.*	*Ins.*
Annapolis	58	12	36.0	7.80	3.0
Bachmans Valley	56	3	28.9	8.24	10.0
Boettcherville	59	5	32.2	4.97	13.5
Cambridge	60	21	36.8	5.36	2.0
Chase	56	0	32.6	7.62	3.5
Cheltenham	60	12	33.4	5.19	3.5
Chestertown	59	15	33.8	6.83	3.5
Chewsville	57	5	30.8	3.98	8.0
Clearspring	58	12	30.4	7.03	13.8
Coleman	59	16	34.6	7.42	4.5
Collegepark	60	7	32.8	5.21	.....
Colora	.....	.....	.....	6.81	8.0
Darlington	59	8	31.3	7.91	7.5
Deerpark	54	— 4	26.6	7.09	22.0
Denton	64	11	35.4	3.15	2.5
Easton	70	16	36.2	4.58	2.4
Fallston	57	6	32.2	6.70	5.0
Frederick	53	9	32.9	5.99	9.5
Grantsville	56	4	27.4	5.72	19.8
Greatfalls	57	11	32.0	5.41	.....
Greenspring Furnace	55	8	30.5	5.67	11.0
Hancock	62	4	31.7	5.46	11.2
Harney	.....	.....	.....	5.51	9.0
Jewell	61	16	36.3	5.59	1.0
Johns Hopkins Hospital	59	18	34.2	7.64	.....
Laurel	58	5	32.3	5.59	5.0
McDonogh [b]	60	10	33.8	4.84	.....
Mount St. Marys College	52	15	31.0	5.58	12.5
New Market	52	14	31.9	6.23	7.0
Princess Anne	64	16	37.1	3.71	1.5
Queenstown	61	19	35.0	7.06	4.0
Sharpsburg	58	16	33.4	.....	4.9
Solomons	63	20	37.8	3.45	1.2
Sudlersville	60	12	34.9	6.21	2.8
Sunnyside	54	— 1	28.0	8.63	19.8
Takoma Park	58	11	32.8	6.06	.....
Van Bibber	55	9	33.3	7.46	.....
Westernport	56	9	31.4	3.07	9.5
Woodstock	59	11	34.0	6.65	5.0
Massachusetts.					
Amherst	49	—15	23.8	4.27	26.5
Bedford	53	—12	25.1	5.60	25.5
Bluehill (summit)	55	—14	26.2	5.50	32.0
Cambridge	56	—11	26.6	5.99	.....
Chestnuthill	55	—10	27.3	5.53	23.0
Cohasset	.....	.....	.....	6.65	24.0
Concord	53	—12	23.2	5.32	25.1
East Templeton [1]	44	—14	22.7	6.01	29.8
Fall River	58	— 7	29.6	6.76	26.0
Fitchburg *a* [1]	46	—12	23.8	6.75	34.0
Fitchburg *b*	50	—14	24.0	6.34	27.0
Framingham	54	—14	25.6	6.61	31.0
Groton	47	—14	23.0	6.39	33.5
Holyoke	.....	.....	.....	8.30	41.2
Hyannis	50	— 8	31.2	6.51	15.5
Jefferson	.....	.....	.....	7.21	31.2
Lawrence	54	—12	24.4	5.92	33.2
Leominster	.....	.....	.....	4.90	29.2
Lowell *a*	51	—11	25.7	6.29	.....
Ludlow Center	47	—19	20.2	6.50	28.5
Middleboro	57	— 9	27.4	6.06	18.6
Monson	53	—12	24.3	7.20	31.0
New Bedford *a*	53	—10	29.1	5.53	28.0
Pittsfield	.....	.....	.....	5.32	18.5
Plymouth [1]	48	— 9	30.1	6.77	27.0
Princeton	.....	.....	.....	7.39	28.5
Provincetown	61	— 2	33.8	6.53	15.8
Salem	.....	.....	.....	5.53	29.0
Somerset [1]	54	—12	30.0	5.83	22.5
Sterling	.....	.....	.....	7.00	22.4
Taunton	55	—15	26.9	5.56	44.5
Webster	.....	.....	.....	6.58	17.8
Westboro	53	—13	25.9	6.41	28.5
Weston	53	—11	24.5	6.43	33.0
Williamstown	47	—14	22.5	4.41	21.0
Winchendon	.....	.....	.....	6.70	32.0
Worcester *b*	52	—13	25.6	5.03	32.0
Michigan.					
Adrian	44	5	25.7	1.60	2.5
Agricultural College	45	— 3	24.8	2.89	9.9
Allegan	49[e]	3[e]	26.4[e]	3.65	21.5
Alma	44	— 1	24.7	2.34	19.0
Ann Arbor	44	2	24.8	2.48	7.9
Annpere	.....	.....	.....	1.10	8.0
Arbela	46	2	25.2	3.44	11.0
Baldwin	44	—10	22.8	1.48	9.5
Ball Mountain	45	2	24.6	1.81	8.9
Baraga	43	— 9	17.8	1.60	16.0
Battlecreek	47	3	25.0	2.47	9.0
Bay City	44	2	24.4	3.18	6.0
Benzonia	43	8	25.5	4.25	29.3
Berlin	44	0	24.6	1.83	8.6
Berrien Springs	51	6	26.7	4.45	24.0
Big Rapids	44	0	23.0	2.93	17.5
Birmingham	46[e]	2	25.6	1.71	11.5
Boon	40	— 6	21.0	2.15	18.2
Calumet	37	3[k]	19.3[e]	4.16	52.0
Carsonville	38[e]	.....	.....	.....	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cassopolis	48	0	25.4	3.60	23.0
Charlevoix	.....	.....	.....	2.45	14.0
Charlotte	59	2	27.3	2.00	5.0
Chatham	40	— 9	20.2	2.55	25.5
Cheboygan	42	1	24.6	1.10	10.5
Clinton	48	— 4	26.2	2.51	8.7
Coldwater	46	2	26.0	2.50	9.0
Deerpark	38	— 1	21.6	5.00	49.0
Detour	39	— 4	22.6	3.34	20.0
Dundee	46	2	26.1	3.14	9.5
Eagle Harbor	40[d]	6[d]	23.2[d]	2.16	21.7
East Tawas	44	4	24.6	2.19	5.0
Eloise	48	3	25.5	2.14	8.9
Ewen	41	1	16.5	1.62	16.2
Fennville	48	8	28.0	2.85	10.2
Fitchburg	44	— 3	24.7	3.39	14.5
Flint	45	— 3	24.7	1.84	6.5
Frankfort	44	16	28.8	1.46	10.0
Gaylord	39	— 8	19.2	1.10	11.0
Gladwin	41	— 2	19.3	1.47	7.0
Grand Marais	40	7	24.0	3.56	35.2
Grand Rapids	49	9	26.6	2.69	5.1
Grape	47	— 6	26.0	2.73	16.1
Grayling	41	—10	21.2	1.70	16.0
Hagar	52	11	29.1	3.01	15.2
Harbor Beach	45	5	27.6	1.65	3.5
Harrison	37	2	19.8	2.80	7.3
Harrisville	47	6	25.0	4.09	27.0
Hart	49	10	26.6	1.56	13.5
Hastings	48	5	25.9	3.20	11.2
Hayes	48	10	24.8	2.16	7.5
Highland Station	.....	.....	.....	2.50	8.5
Hillsdale	48	0	24.9	3.03	15.5
Humboldt	.....	.....	.....	0.97	9.7
Iron Mountain	45	— 6	19.1	1.55	15.5
Iron River	38	—14	15.8	2.45	21.0
Ironwood	40	—11	16.8	1.78	17.8
Ishpeming	38	— 5	17.9	1.50	15.0
Ivan	43	— 1	22.2	2.45	17.0
Jackson	43	2	23.8	2.97	13.5
Jeddo	45	3	24.8	2.20	9.7
Kalamazoo [c]	42	8	26.4	4.06	11.4
Lake City	40	— 5	21.6	0.70	7.0
Lansing	46	2	26.1	2.09	8.6
Lapeer	46	1	24.9	.....	.....
Lathrop [g]	36	—10	16.2	2.68	6.8
Lincoln	48[d]	2[d]	24.0[d]	0.50	5.0
Ludington	44	18	28.6	1.25	11.0
Mackinac Island	41	— 2	24.4	2.37	15.0
Mackinaw	40	0	25.0	2.14	9.2
Manceiona	44	2	22.6	1.55	15.5
Manistee	44	3	26.5	1.75	16.0
Manistique	40	— 3	22.6	2.41	12.0
Menominee	41	— 7	22.8	0.85	8.5
Midland	42	— 7	24.4	2.20	11.0
Mio	40	—12	20.8	1.97	16.2
Montague	46	7	27.2	3.14	13.0
Mount Pleasant	45	2	24.3	1.83	11.0
Muskegon	50	9	27.8	2.35	9.0
Newberry	41	10	23.2	1.30	13.0
North Marshall [f]	44	4	25.8	2.85	5.0
Old Mission [h]	44	11	26.9	1.48	.....
Olivet	43	5	25.6	2.83	7.7
Omer	43	2	24.4	1.12	4.0
Onaway	41	— 4	22.2	1.61	12.5
Ontonagon	45	— 4	18.8	3.90	39.0
Ovid	46	— 3	25.7	1.81	3.5
Owosso	.....	.....	.....	0.61	4.1
Petoskey [c]	42	2	24.0	1.88	16.3
Plymouth	45	5	27.6	1.20	11.0
Port Austin	45	9	26.9	1.18	3.0
Powers	43	— 8	20.9	.....	.....
Reed City	42	— 2	22.9	2.47	15.5
Roscommon	42[d]	—12[d]	23.5[d]	1.12	10.0
Saginaw	46	2	26.0	2.56	10.2
St. Ignace	40	— 2	25.1	0.75	7.5
St. Johns	46	3	26.7	.....	.....
St. Joseph	47	8	27.2	4.05	23.0
Sidnaw	.....	.....	.....	2.25	22.5
Slocum [j]	53	16	29.8	1.73	6.1
Somerset [f]	43	0	21.7	0.90	9.0
South Haven	47	8	27.4	2.32	12.8
Thomaston	42	—15	15.2	2.09	20.0
Thornville	46	6	26.4	2.75	14.0
Traverse City [h]	51	2	29.5	1.55	9.5
Vassar	49	— 6	26.8	1.89	4.1
Wasepi	47	0	23.4	3.76	15.0
Waverly	49	4	26.6	3.21	12.0
Webberville	46	1	25.8	2.00	10.0
West Branch	41	— 3	22.2	2.14	16.5
Wetmore [c]	40	—13	17.6	1.85	18.5
Whitefish Point	44	3	23.1	1.10	11.0
Ypsilanti	48	— 1	24.7	3.46	14.3
Minnesota.					
Ada	38	—24	11.0	0.85	9.0
Albert Lea	40	—15	14.6	1.82	11.0
Alexandria	35	—26	10.7	1.36	9.5
Angus	33	—28	5.1	0.73	7.0
Minnesota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ashby	34	—22	10.8	1.42	13.0
Beardsley	42	—29	11.6	1.30	7.0
Beaulieu	34	—29	8.2	0.38	5.5
Bemidji	38	—32	11.5	0.95	.....
Bird Island	39	—25	12.2	2.39	13.0
Blooming Prairie	38	—15	15.0	1.70	9.5
Brainerd	37	—25	10.2	2.48	14.0
Caledonia	38	—17	16.2	2.27	12.0
Collegeville	39	—20	15.0	1.67	15.1
Crookston	35	—24	9.8	0.45	4.5
Currie	45	—23	12.4	.....	.....
Deephaven	.....	.....	.....	1.62	17.0
Detroit	36	—30	8.1	0.43	4.0
Duluth	33	—22	13.0	2.13	20.0
Faribault	38	—18	14.8	2.37	13.5
Farmington	39	—20[e]	15.2	2.72	25.0
Fergus Falls	36	—22	11.4	0.94	7.5
Glencoe	38	—22	13.3	1.20	11.0
Grand Meadow	37	—16	13.4	3.19	27.0
Hallock	36	—32	5.3	0.18	2.0
Lake Winnibigoshish	41	—30	10.4	1.06	14.5
Leech	38	—30	9.6	1.29	12.5
Long Prairie	37	—29	10.6	1.43	12.5
Luverne	42	—16	14.2	2.55	12.0
Lynd	43	—26	13.4	2.63	18.5
Mapleplain	40	—26	13.2	3.19	25.0
Milaca	35	—28	11.6	0.91	8.0
Milan	39	—30	10.4	2.97	22.8
Minneapolis [b]	39	—21	14.8	2.37	17.7
Montevideo	35	—31	10.6	2.35	19.2
Morris	38	—26	11.3	1.81	17.6
Mount Iron	38	—27	8.8	2.05	20.5
New London	34	—28	8.8	2.00	15.0
New Richland	41	—17	16.4	2.66	13.5
New Ulm	40	—19	15.4	1.74	10.2
Park Rapids	33	—28	10.0	0.96	9.2
Pine River	41	—30	11.3	2.02	16.5
Pipestone	40	—20	12.2	1.52	7.2
Pleasant Mounds	41[f]	—20[f]	15.6[f]	2.46	12.5
Pokegama Falls	42	—45	7.6	1.32	9.5
Redwing [a]	.....	.....	.....	1.56	15.0
Reeds	.....	.....	.....	2.09	19.0
Rolling Green	43	—18	15.4	1.90	7.0
St. Cloud	39	—25	13.2	1.43	11.0
St. Peter	41	—19	17.6	1.07	11.6
Sandy Lake Dam	40	—29	9.6	1.32	12.6
Shakopee	39	—21	14.6	3.10	17.5
Tower	36	—33	10.0	1.80	18.0
Two Harbors	38	—23	15.1	1.87	3.5
Wabasha	44	—16	17.4	2.31	18.0
Willow River	40	—29	13.2	2.11	19.0
Winnebago City	43	—19	15.8	2.08	11.5
Winona	40	—11	17.9	2.46	13.0
Worthington	45	—20	14.2	2.27	11.5
Mississippi.					
Aberdeen	69	17	43.4	6.35	
Agricultural College	70	13	44.9	7.07	T.
Austin	67	16	43.1	12.44	T.
Batesville	70	15	44.8	6.60	
Bay St. Louis	71	26	52.2	7.64	
Biloxi	70	24	52.7	5.71	
Booneville	68	12	41.0	7.10	
Brookhaven	.....	.....	.....	8.00	
Canton	72	18	46.8	5.02	T.
Columbus	78	15	44.8	5.51	
Corinth	.....	.....	.....	8.68	
Crystalsprings	72	19	46.4	7.17	
Edwards	72	19	48.0	5.86	T.
Fayette	73	21	47.6	4.12	
Fayette (near)	.....	.....	.....	4.16	T.
Greenville [a]	69	20	46.0	4.96	T.
Greenville [b]	71	18	44.4	4.95	T.
Greenwood	72	15	43.8	5.28	
Hattiesburg	75	21	50.7	5.15	
Hazlehurst	73	17	46.8	7.14	T.
Hernando	66	14	41.8	.....	
Holly Springs	66	13	40.6	8.17	
Indianola	72	18	45.6	3.90	
Jackson	.....	.....	.....	5.72	1.0
Kosciusko	71	15	44.9	5.38	T.
Lake	70	16	44.4	6.22	T.
Lake Como	73	18	48.3	6.07	
Laurel	76	20	50.7	5.33	
Leakesville	78	20	51.6	5.47	
Louisville	73	12	46.2	4.75	T.
Macon	79	16	45.3	4.27	
Magnolia	75	21	49.4	6.64	
Natchez	76	23	50.8	4.25	
Nittayuma	72	18	44.6	4.03	T.
Okolona	68	13	42.8	7.01	T.
Palo Alto	73	15	45.0	7.30	T.
Patmos	.....	.....	.....	4.73	T.
Pearlington	80	24	50.1	7.48	
Pittsboro	70	13	43.8	6.88	0.5
Pontotoc	68	13	43.2	5.73	2.0
Poplarville	73	22	51.8	6.15	
Port Gibson	74	24	48.3	4.26	T.
Ripley	65	11	41.1	4.20	
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Shoccoe	72	17	46.2	5.53	T.
Stonington	.....	.....	.....	4.23	T.
Suffolk	72	20	49.1	7.04	T.
Swartwout	76	23	54.1	9.75	
Thornton	72	26	45.4	.....	T.
Tupelo	72	12	42.6	8.20	
University	70	13	43.8	6.01	1.0
Walnutgrove	75	17	46.4	4.35	0.5
Watervalley	.....	.....	.....	5.46	3.5
Waynesboro	74	19	49.4	4.71	
Woodville	72	22	49.5	7.90	
Yazoo City	73	20	45.5	4.07	T.
Missouri.					
Appleton City	58	2	31.0	3.17	T.
Arthur	61	4	33.2	2.27	T.
Avalon	56	— 5	27.6	1.85	.....
Bethany	52	— 5	25.2	2.16	4.0
Birchtree	60[c]	4[c]	34.6[c]	3.85	T.
Boonville	.....	.....	.....	1.82	0.1
Brunswick	57	— 2	28.4	2.02	T.
Carrollton	56	— 2	29.0	0.94	T.
Caruthersville	66	12	40.0	9.31	T.
Conception	53	0	23.6	1.42	7.0
Darksville	55	— 2	27.6	0.71	1.8
Dean	62	5	35.7	4.21	2.0
Desoto	60	3	33.8	3.83	0.2
Downing	.....	.....	.....	2.10	5.5
Edgehill	61	6	35.2	3.60	T.
Edwards	60[f]	2	33.4[c]	2.17	T.
Eightmile [c g]	.....	1	28.8	1.97	1.0
Fairport	.....	.....	.....	1.34	4.5
Fayette	59	1	30.8	1.67	T.
Fulton	57	1	31.0	1.98	1.0
Galena	.....	.....	.....	4.80	10.0
Gallatin [c i]	56	— 1	27.9	1.69	3.7
Glasgow	55	— 1	29.0	1.58	0.5
Gorin	.....	.....	.....	2.06	4.6
Grant City	53	— 7	23.8	1.55	6.0
Harrisonville	55	1	28.3	1.99	1.0
Hazlehurst	.....	.....	.....	1.47	4.0
Hermann	.....	.....	.....	2.54	0.2
Houston	65	3	35.0	3.93	4.0
Huntsville	55	— 2	29.0	1.42	.....
Ironton	66	2	33.6	4.08	1.0
Jackson	65	6	36.4	6.35	0.5
Jefferson City	58	1	30.6	3.47	1.8
Joplin	64	5	36.4	1.64	1.2
Kidder	55	— 4	25.5	1.63	4.8
Koshkonong	59	6	36.2	5.33	T.
Lamar	61	4	34.3	2.09	T.
Lamonte	.....	.....	.....	2.09	2.5
Lebanon	59	2	32.9	3.96	6.0
Lexington	57	— 1	29.2	1.94	3.5
Liberty	57	— 1	28.0	1.34	1.6
Louisiana	57	0	29.6	2.99	0.2
Macon	55	— 3	27.8	1.99	3.8
Marblehill	65	5	35.8	6.00	0.5
Marshall	55	— 5	29.2	2.38	1.1
Maryville	53	— 6	21.8	2.05	8.2
Mexico	58	0	29.2	2.14	1.0
Miami [c b]	54	— 1	28.3	1.52	4.4
Mineralspring	56	4	33.8	3.30	9.0
Monroe City	56	— 4	27.0	2.30	2.8
Montreal	61	1	32.4	2.80	4.5
Mountaingrove	59	2	33.7	3.43	5.0
Mount Vernon	68	4	35.4	5.16	5.0
Neosho	63	6	35.8	3.34	2.0
Nevada	62	3	33.3	2.19	T.
New Haven	60	3	33.1	4.21	4.0
New Madrid [b]	.....	.....	.....	8.62	.....
New Palestine	56	3	31.6	1.70	1.4
Oakfield	58	2	32.4	3.98	3.2
Olden	.....	.....	.....	4.99	3.5
Oregon	55	— 5	25.4	2.41	12.8
Palmyra [c b]	58	— 2	27.8	1.78	3.0
Pine Hill	.....	.....	.....	2.69	0.6
Poplarbluff	64	9	37.6	7.23	
Princeton	50	— 6	24.9	1.85	7.0
Rockport	.....	.....	.....	2.44	8.0
Rolla	.....	.....	.....	4.82	4.2
St. Charles	58	2	32.4	4.18	3.0
St. Joseph	.....	.....	.....	1.74	9.0
Sarcoxie	.....	.....	.....	3.08	2.5
Sedalia	57	0	31.0	1.85	3.0
Seymour	58	0	32.6	4.37	7.0
Shelbina	.....	.....	.....	1.46	0.8
Sikeston	64	9	37.3	7.16	T.
Steffenville	56	— 2	27.6	2.57	7.0
Trenton	51	— 3	26.0	2.02	5.7
Unionville	52	— 6	23.9	1.98	6.5
Vichy	59	0	31.8	4.71	3.2
Warrensburg	55	1	30.8	1.68	1.0
Warrenton	58	1	29.0	3.75	2.0
Wheatland	.....	.....	.....	1.95	0.5
Willowsprings	62	3	33.8	4.62	4.0
Windsor	.....	.....	.....	1.53	2.7
Zeitonia	64	4	35.0	3.95	0.8

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Montana.	°	°	°	*Ins.*	*Ins.*
Anaconda	47	5	25.6	1.18	8.3
Augusta	52	−17	24.2	1.00	10.0
Billings	57	− 4	24.0	.....	.....
Boulder	50	− 3	21.6	1.05	10.5
Bozeman	52	− 1	23.6	0.73	
Butte	51	4	26.6	0.90	9.0
Canyon Ferry	53	− 5	19.3	0.74	6.9
Columbia Falls	41	5	24.3	3.48	12.0
Crow Agency	53	− 4	21.3	0.70	7.0
Culbertson	38	−32	5.4	0.33	3.0
Deerlodge	55	− 2	24.2	0.06	0.6
Dillon	48	4	25.8	0.56	5.0
Ekalaka	52	−18	18.0	0.60	6.0
Fort Benton (*a*)	42	−20	16.4	0.90	9.0
Fort Logan	49	−11	17.2	0.12	1.2
Glasgow	32	−29	2.6	0.54	5.4
Glendive	46	−20	8.8	1.50	15.0
Greatfalls	52	−10	23.6	0.39	3.9
Hamilton	52	6	29.6	1.41	9.0
Kipp	50	−25	15.8	1.30	13.0
Lewistown	55	−11	21.6	1.30	13.0
Livingston	52	−19	22.0	0.13	1.3
Manhattan	50[e]	−12[e]	19.6[e]	.....	.....
Marysville	46[e]	−12[e]	21.2[e]	1.85	13.5
Missoula	44	4	26.2	.....	.....
Parrot	52[f]	5[f]	26.4[f]	.....	.....
Plains	45	9	26.6	2.40	23.0
Poplar	38	−29	4.6	1.06	10.6
Redlodge	57	.....	.....	0.50	5.0
Ridgelawn	38	−25	7.2	1.17	11.7
St. Pauls	57	−13	21.0	1.01	10.1
St. Peter	51	−18	25.0	0.30	3.0
Springbrook	42	−25	12.8	1.36	13.6
Toston	55	−10	20.4	0.87	8.7
Townsend	56	−11	20.9	0.58	5.8
Troy	40	6	26.6	5.81	21.5
Twin Bridges	52[d]	1[d]	23.2[d]	.....	.....
Twodot	52	− 8	17.2	1.80	18.0
Utica	55	−13	24.9	0.25	2.5
Winston	52	− 6	22.7	0.75	8.0
Yale	50	− 7	21.9	0.80	8.0
Nebraska.					
Agate	47[j]	− 9[j]	21.2[j]	1.60	16.0
Agee *1	48	−20	16.2	3.95	39.5
Albion	43[f]	−12[f]	18.2[f]	1.00	10.0
Alliance	52[f]	−10[f]	17.7[f]	1.55	15.5
Alma	60	−11	20.8	1.18	11.2
Ames	52	− 8	21.0	2.08	8.0
Ansley	48	− 5	19.0	1.10	11.0
Arapahoe	.....	.....	.....	0.70	7.0
Arborville	.....	.....	.....	0.59	6.0
Arcadia	.....	.....	.....	0.60	6.0
Ashland *a*	52	− 7	22.0	1.79	11.5
Auburn	57	− 5	23.8	2.18	12.5
Aurora	51	− 6	20.6	0.80	8.0
Bartley	.....	.....	.....	0.55	6.0
Beatrice	51	− 5	23.2	0.85	6.8
Beaver	61	− 4	23.0	0.79	7.5
Bellevue	.....	.....	.....	2.55	8.7
Benedict	.....	.....	.....	1.00	10.0
Benkleman *1	44	− 5	23.8	1.50	9.0
Blair	50	−11	18.4	2.08	10.0
Bluehill *1	43	− 8	23.2	0.35	3.5
Bradshaw	.....	.....	.....	0.70	7.0
Bridgeport	50	− 6	22.8	0.80	8.0
Brokenbow	56	− 7	20.4	0.72	7.2
Burchard	.....	.....	.....	1.47	7.0
Burwell	.....	.....	.....	0.95	9.5
Callaway	52	− 7	18.2	0.95	12.0
Cedar Rapids	55[g]	− 2[g]	21.0[g]	0.58	5.8
Central City	.....	.....	.....	0.80	8.0
Chester	.....	.....	.....	0.50	5.0
Cody	.....	.....	.....	0.95	9.5
Columbus	53	− 9	19.4	0.91	9.0
Crete	51	− 7	22.2	1.84	9.2
Culbertson	.....	.....	.....	0.80	8.0
Curtis[k]	60	1	20.0	1.20	12.0
Dawson	57	− 4	26.0	1.38	8.0
Edgar	.....	.....	.....	0.39	3.9
Ericson	.....	.....	.....	0.90	9.0
Ewing	.....	.....	.....	1.20	12.0
Fairbury	54	− 6	21.5	0.89	7.2
Fairmont	51	− 7	20.5	0.65	6.5
Fort Robinson	55[k]	− 2	22.7[k]	2.65	26.5
Franklin	59	− 9	19.8	0.85	8.5
Fremont	51	−10	17.6	2.20	8.9
Fullerton	.....	.....	.....	0.90	8.5
Geneva	51	− 6	21.7	0.65	6.5
Genoa (near)	51	−10	18.3	0.98	10.5
Gering	60	− 2	25.0	1.13	11.3
Gosper	.....	.....	.....	1.16	12.0
Gothenburg	62	− 1	21.2	1.10	11.0
Grand Island *b*	56	− 6	21.4	1.07	10.7
Greeley	.....	.....	.....	0.39	3.9
Guide Rock	.....	.....	.....	0.85	8.5
Haigler	.....	.....	.....	0.50	5.0
Hartington	54	−18	18.6	2.12	9.5
Harvard	52	− 5	20.6	0.90	9.0
Hastings *1	53	− 3	21.0	0.80	8.0
Hayes Center	.....	.....	.....	1.45	14.5
Hay Springs	48	− 5	21.0	1.98	21.0
Hebron	52	− 3	23.4	1.17	9.7
Hickman	.....	.....	.....	1.35	10.0
Holbrook	.....	.....	.....	0.74	7.4
Holdrege	57	0	23.4	1.20	12.0
Hooper *1	47	− 7	19.5	2.06	12.5
Imperial	60	− 4	20.6	1.84	16.2
Johnstown	.....	.....	.....	2.40	24.0
Kearney	58	− 1	23.7	0.55	5.5
Kennedy	55	− 2	22.8	2.80	28.0
Kimball	54	4	26.0	2.05	20.5
Kirkwood	55	−16	18.4	2.70	27.0
Laclede	55	−10	19.8	1.10	10.0
Lexington	60	− 5	20.1	1.04	9.0
Lodgepole	49	− 3	22.8	1.70	17.0
Loup	68	−10	19.8	1.00	10.0
Lynch	51	−23	15.7	1.99	18.4
Lyons	.....	.....	.....	2.09	13.0
McCook *1	51	− 2	25.2	0.60	6.0
McCool Junction	.....	.....	.....	0.50	.....
Madison	52	−13	19.6	1.25	12.5
Madrid	.....	.....	.....	0.90	9.0
Marquette	.....	.....	.....	0.95	9.5
Mason	.....	.....	.....	1.10	11.0
Minden *b*	56	− 4	20.4	0.91	8.0
Nebraska City *c*	52	− 6	22.0	2.30	15.0
Nemaha	.....	.....	.....	1.44	.....
Norfolk	52	−17	17.2	1.35	13.5
North Loup	59	− 8	20.7	0.53	5.3
Oakdale	52	−17	16.2	1.08	11.7
Odell	.....	.....	.....	1.50	8.5
O'Neill	64	−19	16.8	2.10	21.0
Palmer	.....	.....	.....	0.70	7.0
Palmyra *1	52	− 8	21.0	1.94	.....
Pawnee City	.....	.....	.....	1.71	7.2
Plattsmouth *b*	51	− 8	20.4	1.60	14.0
Purdum	58	− 5	19.4	1.88	17.8
Ravenna *a*	56	− 7	20.6	1.03	9.4
Redcloud	55	− 2	21.8	0.67	6.7
Republican *1	58	−10	22.6	0.95	9.5
Rulo	.....	.....	.....	0.87	7.5
St. Libory	.....	.....	.....	1.10	11.0
St. Paul	56	− 6	22.2	0.83	7.9
Salem *1	53	− 2	25.6	2.19	7.0
Santee	52	−19	17.5	2.14	20.8
Schuyler	.....	.....	.....	1.30	8.0
Seward	53	− 4	20.0	1.07	6.7
Smithfield	.....	.....	.....	0.80	8.0
Springview	.....	.....	.....	3.60	36.0
Stanton	52	−14	18.2	1.64	14.0
State Farm	52	− 9	22.0	2.23	13.5
Strang *1	50	− 4	24.3	0.45	4.5
Stratton	.....	.....	.....	1.30	11.2
Superior	52	− 2	21.2	0.80	8.0
Syracuse	.....	.....	.....	2.01	10.0
Tablerock	50	− 6	21.8	1.36	7.0
Tecumseh *b*	48	− 1	22.5	.....	.....
Tecumseh *c*	.....	.....	.....	1.98	8.8
Tekamah	51	−11	20.7	2.48	14.5
Turlington	50	− 8	22.0	2.74	17.0
Wakefield	49	−16	17.8	2.26	13.8
Wallace	.....	.....	.....	0.80	8.0
Weeping Water	46	−14	19.4	2.27	14.8
Westpoint	52	−13	18.8	1.94	15.6
Wilber *1	52	− 6	23.1	1.13	4.5
Wilsonville	.....	.....	.....	0.48	5.6
Winnebago	.....	.....	.....	1.73	17.0
Wisner	.....	.....	.....	2.44	16.0
Wymore	.....	.....	.....	1.32	11.5
York	52	− 5	22.2	0.50	5.0
Nevada.					
Amos	60	0	30.6	0.40	0.8
Austin	57	11	33.8	0.39	
Battle Mountain	62[b]	1	34.2[e]	0.00	
Beowawe *1	68	1	36.3	0.20	2.0
Belmont	46	9	27.3	0.10	1.0
Candelaria	58[d]	17[d]	34.8[d]	T.	T.
Carlin	.....	.....	.....	0.20	
Carson City	68	11	36.9	0.61	T.
Cranes Ranch	.....	.....	.....	0.16	
Elko	52	− 2	29.4	.....	.....
Ely	50	0	26.2	1.42	9.0
Eureka	53	7	30.7	0.30	T.
Golconda *1	55	10	34.7	.....	.....
Halleck *b	54	0	28.8	.....	.....
Hawthorne	68	15	36.8	0.00	
Humboldt	55	10	33.9	T.	
Lee	.....	.....	.....	0.24	3.0
Lewers Ranch	63	13	37.2	2.79	2.0
Lovelocks	63	4	36.2	0.00	
Martins	78	9	38.4	0.22	
Mill City *1	60	8	37.3	0.00	
Morey	55	7	29.8	0.35	4.0
Palisade	69	1	33.4	0.20	2.0
Palmetto	57	5	30.8	0.20	2.0
Potts	52	− 2	30.0	0.27	1.0
Reno State University	68	12	36.4	0.20	T.
Rioville	76	21	46.7	0.44	
Sodaville	62	8	33.6	T.	T.
Tecoma	.....	.....	.....	T.	T.
Toano	.....	.....	.....	0.64	5.0
Wabuska	65	.....	.....	0.00	
Wadsworth	67	4	35.0	0.15	
Wells *1	54	1	29.8	0.20	2.0
Wood	59	3	29.7	1.75	.....
New Hampshire.					
Alstead	43	−17	20.6	6.76	30.5
Berlin Mills	43	−25	16.8	3.30	23.7
Bethlehem	45	−21	17.9	2.76	17.5
Brookline *1	46	−26	22.9	4.50	24.2
Chatham	48	−26	17.6	3.40	29.4
Concord	47	−15	20.9	6.14	28.2
Durham	53	−22	25.0	5.87	22.0
Franklin Falls	47	−14	20.7	6.12	34.3
Grafton	45	−17	18.5	5.28	32.0
Hanover	46	−21	18.7	4.29	28.2
Keene	48	−22	20.6	5.55	26.8
Littleton	40	−23	16.2	2.03	21.0
Manchester	.....	.....	.....	5.45	.....
Nashua	48	−14	22.6	6.16	26.5
Newton	53	−16	23.6	4.48	26.0
North Stratford	.....	.....	.....	2.65	.....
Peterboro	47	−20	20.8	7.09	27.5
Plymouth	45	−14	19.4	5.22	34.8
Sanbornton	46	−17	19.2	5.43	27.0
Sewalls Falls	.....	.....	.....	5.52	25.7
Stratford	42	−24	14.6	3.63	23.6
West Stewartstown	.....	.....	.....	3.19	21.9
New Jersey.					
Asbury Park	55	10	34.9	8.71	3.5
Barnegat	61	8	34.8	8.93	T.
Bayonne	57	8	31.4	6.88	11.8
Belvidere	50	3	27.6	8.99	17.5
Bergen Point	57	7	31.2	7.75	15.3
Beverly	60	10	32.6	6.70	8.8
Blairstown	49	− 4	26.2	6.65	11.0
Bridgeton	58	15	35.1	6.29	2.0
Camden	58	16	33.5	7.29	4.5
Canton	.....	.....	.....	5.83	
Cape May C. H.	60	13	36.0	6.34	T.
Charlotteburg	54	− 5	28.0	6.85	15.0
Chester	56	2	27.2	6.15	16.0
Clayton	60	12	33.0	6.11	2.5
College Farm	59	8	30.6	6.83	8.0
Culvers Lake	.....	.....	.....	8.01	21.1
Dover	54	0	27.4	7.79	18.0
Egg Harbor City	61	11	34.3	7.33	2.0
Elizabeth	57	6	31.4	6.91	15.0
Englewood	58	6	32.9	6.93	11.0
Flemington	58	4	30.0	5.85	7.5
Freehold	58	6	30.8	7.80	.....
Friesburg	58	10	33.8	5.98	2.6
Hanover	56	0	28.5	7.95	16.5
Hightstown	60	11	31.8	7.28	7.5
Imlaystown	59	10	32.4	6.39	4.5
Indian Mills	62	8	34.0	7.84	3.5
Lakewood	59	10	33.8	7.44	2.2
Lambertville	58	9	30.6	7.39	10.8
Layton	51	−11	23.8	7.06	23.5
Moorestown	60	12	32.9	7.34	6.4
Mount Pleasant	.....	.....	.....	6.40	0.2
Newark	56	6	30.3	7.37	17.8
New Brunswick	58	8	31.2	7.76	9.3
New Egypt	.....	.....	.....	5.89	4.0
Newton	51	0	25.4	6.87	24.0
Oceanic	58	10	33.7	7.55	8.0
Paterson	54	8	31.8	8.33	22.2
Pemberton	60	9	32.7	6.78	4.7
Piscataway	.....	.....	.....	6.67	8.5
Plainfield	58	6	30.0	7.60	12.8
Rancocas	.....	.....	.....	6.94	5.0
Ringwood	55	− 8	28.0	5.57	14.0
Rivervale	55	− 9	28.2	8.16	32.0
Roseland	.....	.....	.....	7.45	8.0
Salem	58	13	34.0	7.11	3.7
Somerville	58	5	29.7	7.71	13.0
South Orange	55	5	29.7	7.46	16.0
Sussex	49	− 4	26.3	8.11	31.5
Three Bridges	.....	.....	.....	7.26	10.5
Toms River	61	7	33.2	7.51	1.6
Trenton	58	12	35.6	4.86	7.0
Tuckerton	61	8	34.5	8.19	0.5
Vineland	60	13	34.0	6.85	2.8
Woodbine	60	10	34.4	6.69	1.0
Woodstown	.....	.....	.....	6.55	3.0
New Mexico.					
Alamagordo	67	13	41.7	0.60	T.
Albert	74	10	38.9	0.75	6.0
Albuquerque	59	12	34.4	0.84	
Alma	70	10	40.1	1.61	
Arabella	79	10	42.5[e]	0.51	1.3
Bellranch	.....	.....	.....	0.53	4.0
Bluewater	56	− 7	24.7	0.60	5.0
Cambray	.....	.....	.....	1.45	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Mexico—Cont'd.	°	°	°	*Ins.*	*Ins.*
Carlsbad	82	17	45.6	0.68	
Clouderoft	50	0	29.7	2.60	15.0
Deming				1.30	T.
Dorsey	65	1	32.6	0.80	9.0
East View	57	— 5	30.7	2.77	11.0
Espanola	58	— 1	28.6	0.30	4.0
Folsom	63	— 4	31.0	0.63	7.5
Fort Bayard	64	16	39.9	3.00	0.6
Fort Stanton	65	9	36.6	0.57	5.7
Fort Union	73	— 6	35.0	0.84	9.5
Fort Wingate	62	0	33.9	1.22	9.2
Gage				1.30	T.
Gallinas Spring	69	— 6	35.0	0.67	10.0
Las Vegas	70	— 9	32.7	0.93	12.0
Las Vegas Hot Springs	68	2	35.2	1.29	11.8
Lordsburg				1.12	T.
Mesilla Park	70	16	42.3	0.99	T.
Olio	59	5	28.6	0.12	1.2
Raton	65	6	32.8	0.22	2.2
Roswell	72	12	42.0	0.50	T.
San Marcial	65[4]	13[4]	38.3[4]	T.	
Strauss[j]	73	30	48.0	1.50	T.
Taos	60	— 9	25.9	0.85	10.0
Winsors Ranch	59	— 8	28.6	1.85	14.0
New York.					
Adams				3.16	31.5
Addison	55	— 4	26.7	2.50	16.0
Adirondack Lodge	40	—26	17.0	3.73	14.0
Akron				2.48	
Alden	51	— 5	26.6	3.33	21.6
Amsterdam				7.15	43.0
Angelica	50	—11	24.6	1.95	19.5
Appleton	54	4	27.6	1.61	12.0
Arcade	50	—16	22.2	2.63	26.3
Athens	49	—10	23.3	6.29	35.9
Atlanta	51	—18	23.2	2.59	18.5
Auburn	50	— 7	25.4	2.95	33.0
Avon	52	3	25.7	1.41	
Axton	39	—30	15.6	2.96	13.5
Baldwinsville	49	— 8	24.8	4.32	30.5
Bedford	55	— 3	27.6	5.30	
Blue Mountain Lake				3.45	24.0
Bolivar	49	— 7	23.0	3.08	25.3
Bouckville	46	—16	21.6	5.37	39.5
Boyds Corner				7.59	
Brockport	49	2	25.2	3.25	29.0
Caldwell	48	—14	21.1	6.01	31.4
Canaan Four Corners	47	—17	21.3	3.40	27.5
Canajoharie	50	—16	20.8	5.43	38.9
Canton	45	—25	18.6	2.31	14.8
Carmel	48	— 9	26.4	7.30	26.5
Carvers Falls	47	—25	17.9	3.51	14.0
Cedarhill	49	—10	22.6	3.58	26.5
Cooperstown	47	—13	21.4	4.30	25.0
Cortland	50	— 8	24.6	4.78	
Cutchogue	53	2	32.2	7.52	14.0
Dekalb Junction				3.90	19.5
Easton				4.23	29.0
Elba	46	— 5	24.0	3.53	22.0
Elmira	53	4	27.2	1.96	15.0
Fayetteville	52	—13	25.2	3.13	25.0
Franklinville	53	—14	23.4	2.75	17.9
Gansevoort				6.65	35.5
Glens Falls	48	—15	21.4	5.83	28.2
Gloversville	46	—20	20.2	7.01	49.5
Greenwich	46	—26	20.0	4.59	17.3
Griffin Corners	49[b]	—12	21.8[b]	5.03	30.6
Harkness	44	—17	19.0	1.46	15.0
Haskinville				1.90	14.0
Hemlock	50	— 6	26.8	1.75	19.5
Honeymead Brook	51	—12	22.8	5.80	21.0
Indian Lake	45	—22	17.8	3.55	28.5
Ithaca	52	— 1	25.2	4.30	44.9
Jamestown	54	— 6	25.0	3.62	24.4
Keene Valley	45	—20	18.9	3.41	14.3
King Ferry				3.23	40.5
Littlefalls, City Res.	48	—18	20.7	3.47	31.5
Lockport	50	4	26.9	1.97	14.6
Lowville	44	—25	18.4	3.73	20.0
Lyons	52[c]	— 8[c]	26.0[c]	3.82	26.5
Middletown	59	— 2	26.0	6.48	28.6
Mohonk Lake	47	— 7	22.2	6.86	35.0
Newark Valley				3.77	21.0
New Lisbon	47	—19	20.0	5.55	38.8
North Hammond				2.25	13.1
Number Four	44	—28	19.4	5.40	35.3
Nunda	53	— 8	26.6	2.51	18.7
Ogdensburg	46	—20	18.3	2.16	
Old Chatham				5.32	26.0
Oneonta	49	—12	23.5	4.61	31.0
Otto	49	—20	22.8	2.24	
Oxford	48	—15	23.0	6.11	39.8
Palermo				5.90	44.0
Penn Yan	49	0	25.0	1.55	13.3
Perry City	50	— 5	23.2	3.69	28.2
Plattsburg	45	—15	20.0	2.50	5.0
Port Jervis	49	— 7	24.6	6.29	28.0
Primrose	56	0	28.9	6.72	16.7
Redhook				7.72	
Richmondville	48	—16	22.0	4.45	34.0
Ridgeway	50	2	26.5	3.15	24.0
Rome	48	—19	23.4	4.68	25.4
Romulus	55	— 3	25.4	4.68	29.0
Salisbury Mills				7.88	
Saranac Lake	45	—23	17.5	2.73	11.7
Saratoga Springs	47	—28	20.4	4.51	32.5
Setauket	57	3	32.6	7.46	11.0
Shortsville	54	— 1	25.2	3.10	23.0
Skaneateles				3.63	
Southampton	54	3	32.9	7.47	8.0
South Canisteo	54	—11	24.4	3.05	23.0
Southeast Reservoir				7.34	
South Kortright	52	—20	21.8	4.11	26.5
South Schroon	44	—21	18.5	4.09	24.2
Speer Falls	48	—16	20.4	6.11	
Straits Corners	55[c]	— 3[c]	23.0[c]	2.60	21.0
Ticonderoga	47	—17	21.9	1.67	
Volusia	50	5	24.8	3.33	
Walton	50	—13	23.0	4.20	42.2
Wappinger Falls	48	—14	23.2	9.25	45.0
Warwick				6.20	
Watertown	45	—22	21.6	2.81	24.0
Waverly	52	— 9	24.9	3.19	26.8
Wedgwood	52	— 1	23.4	3.25	25.7
Wells	49	—28	19.9	7.20	40.1
West Berne	51	—21	20.5	4.36	37.0
Westfield *b*	53	7	26.8	2.83	
Westfield *e*				2.05	
Windham	53	—12	24.3	5.75	37.8
Wolcott	51	— 9	24.2	5.15	34.0
Youngstown				1.66	9.5
North Carolina.					
Brevard	69	8	38.0	7.00	T.
Brewers	72	14	38.8	5.22	
Bryson City				4.13	T.
Chapelhill	69	14	40.6	4.88	
Cranberry	55	5	35.2	3.75	3.2
Currituck				3.19	
Edenton	70	20	45.6	1.78	T.
Fayetteville	71	16	44.2	3.78	
Goldsboro	70	16	43.3	2.98	T.
Graham				4.33	
Greensboro	65	15	39.8	3.38	
Henderson	67	16	42.1	3.15	T.
Hendersonville	71	10	40.7	5.65	
Henrietta	66	14	41.8	4.45	
Highlands	59	0	33.6	7.35	2.0
Horse Cove	63	8	39.0	8.84	0.5
Hot Springs	65	12	41.2		2.0
Kinston	71	16	45.5	1.82	T.
Kittyhawk	68	22	45.3	5.13	
Lexington	69	14	42.0	4.60	
Linville	56	0	32.3	3.93	3.0
Littleton	68	15	39.8	3.29	0.5
Louisburg	68[l]	16[a]	41.4[b]	2.52	0.5
Lumberton	69	18	44.6	3.28	
Marion	67[c]	13[c]	39.9[c]	7.23	T.
Mocksville	67	11	37.4	4.03	
Moncure	70	11	42.0	4.84	
Monroe	69	11	42.4	3.13	
Morganton	67	13	40.6	4.26	
Mountairy	64	16	38.2	4.16	T.
Murphy				4.78	T.
Newbern	76	16	46.2	4.52	
Patterson [1]	60	13	34.8	4.59	0.2
Pittsboro	68	13	43.6	2.75	
Reidsville	68	14	40.0	4.49	
Rockingham	73	16	44.6	2.74	
Roxboro	66	15	40.2	3.36	
Salem	64	17	38.9	4.80	
Salisbury				5.53	
Saxon	64	8	38.8	4.07	
Selma	70	15	42.5	3.35	
Settle	68	7	41.2	4.31	T.
Sloan	76	16	46.5	3.51	
Soapstone Mount	67	10	39.8	3.70	T.
Southern Pines *a*	70	15	44.0	2.97	
Southern Pines *b*	69	15	44.4	3.10	
Southport	69	17	50.5	6.38	
Springhope [1]	68	18	42.9	2.45	T.
Statesville	67	9	38.6	4.11	T.
Tarboro	72[c]	18[c]	42.4[c]	2.18	T.
Washington	74	25	46.2	1.95	T.
Waynesville	65	12	41.9	2.52	T.
Weldon *a*	67	19	40.2	3.76	
Weldon *b*				3.54	
North Dakota.					
Amenia	40[c]	—28[c]	8.2[c]	0.48	4.8
Ashley	38	—25	8.1	0.30	3.0
Berlin	41	—30	7.7	0.80	8.0
Bottineau	29	—30	2.4	0.20	2.0
Buxton	37	—26	8.4	0.59	5.9
Churchs Ferry	36	—30	4.0	0.43	4.3
Coalharbor	35	—24	7.4	0.76	7.6
Devils Lake	35	—29	4.6	0.10	1.0
Donnybrook				0.60	6.0
Dunseith	32	—33	3.0	0.20	2.0
Edgeley	48	—24	11.3	0.87	6.3
Ellendale	37	—28	10.6	1.10	11.0
Fargo	35	—31	7.6	0.27	2.7
Forman	34	—29	6.7	0.45	4.5
Fort Yates	48	—18	13.6		
Fullerton	36	—30	8.8	1.10	11.0
Gallatin	36	—28	8.5	0.28	2.8
Glenullin	43	—19	12.8	0.10	1.1
Grafton	40[d]	—24	6.6[c]	0.30	3.0
Hannaford	38	—31	7.6	0.41	4.1
Jamestown	49	—24	7.0	0.40	4.0
Larimore	39	—24	6.8	0.30	3.0
McKinney	37	—35	1.0	0.90	9.0
Mayville	38	—25	8.0	0.47	4.7
Medora	43[d]	—19[d]	12.2[c]	0.30	3.0
Melville	45	—29	9.9	0.10	1.0
Milton	31	—31	3.2	0.58	5.8
Minnewaukon	33	—29	7.5	T.	T.
Minot	37	—27	11.0	0.50	5.0
Minto	40	—25	6.0	0.18	1.8
Napoleon	40	—25	9.8	0.25	2.5
New England	42	—24	11.2	0.53	5.3
Oakdale	49	—22	12.4	1.10	11.0
Pembina	36	—31	3.8	0.50	5.0
Portal	32	—32	1.6	1.55	15.5
Power	38	—28	8.8	0.40	4.0
Steele	37	—27[d]	8.2	0.10	1.0
University	39[a]	—27	5.6[c]	0.46	4.6
Valley City	40[a]	—29[d]	2.0[c]	0.47	4.7
Wahpeton	38	—23	10.8	1.32	
Willow City	35	—36	1.0	0.20	2.0
Ohio.					
Akron	55	4	27.8	3.53	13.8
Atwater	50	— 4	26.3	4.62	13.5
Bangorville	53	— 4	27.0	4.02	7.2
Bellefontaine	59	5	27.4		
Bement				3.66	23.0
Benton Ridge	52	— 1	28.0	3.13	15.3
Bethany	58	— 3	32.2	3.92	4.0
Binola				2.66	14.5
Blaine				5.36	17.5
Bloomingburg				3.90	6.0
Bowling Green	50	0	26.7	3.33	6.5
Bucyrus	50	0	27.8	2.10	6.0
Cambridge	59	— 5	31.2	4.87	14.0
Camp Dennison	59	— 8	32.8	5.27	7.4
Canal Dover	56	— 6	29.2	4.09	9.5
Canton	54	1	28.1	3.85	13.6
Cardington	53	— 9	28.4	3.18	8.0
Cedarville				3.86	7.0
Centerburg				5.10	12.5
Circleville	58	8	32.2	4.56	10.8
Clarington					2.0
Clarksville	58	— 6	32.0	4.27	9.2
Cleveland *a*	56	6	30.0	3.26	21.0
Cleveland *b*	55	5	28.5	3.12	20.2
Clifton	60	— 5	31.7	3.66	5.8
Coalton	59	5	33.6	4.73	8.0
Colebrook	53	— 2	27.6	3.50	15.0
Coolville				4.77	8.0
Coshocton				4.52	14.2
Dayton *a*				2.77	5.4
Dayton *b*	56	— 5	30.6	3.95	4.9
Defiance	49	2	27.2	3.10	13.1
Delaware	54	— 9	28.7	3.11	6.7
Demos	56	6	30.6	5.19	10.0
Dunham				4.39	3.3
Dunkirk				2.15	
Elyria	57	1	28.4	2.39	
Findlay	53	1	28.0	2.64	9.5
Fort Recovery				2.99	3.9
Frankfort	57	2	31.8	4.11	6.2
Fremont	52	4	28.6	3.61	14.8
Galigher				4.78	
Garrettsville	54	—11	27.8	4.32	18.8
Granville	56[c]	—10[c]	29.2[c]	4.01	10.5
Gratiot	56	— 7	30.0	4.76	8.7
Green	61	11	34.8	5.60	1.0
Greenfield	58	5	31.0	5.05	9.0
Greenhill	55	— 8	27.2	3.87	10.5
Greenville	51	4	29.6	3.47	3.5
Hanging Rock	62	12	36.5	6.38	
Hedges	49	2	26.6	2.97	5.6
Hillhouse	52	3	26.8	3.64	22.0
Hiram	51	1	26.0	4.40	17.0
Hudson	53	— 3	25.6	4.26	15.0
Jacksonboro	55	0	29.4	4.51	7.5
Killbuck [d]	53	0	27.2		
Lancaster	59	1	30.8	4.22	6.2
Lima	49	4	26.8	3.49	14.0
McConnelsville	60	1	31.6	4.86	10.5
McCormick				5.48	
Manara	55	— 8	29.8	4.05	8.0
Mansfield				3.56	10.3
Marietta	60	11	34.7	5.48	5.5
Marion	52	0	28.2	3.15	8.0
Medina	53	— 5	27.7	3.53	14.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Milfordton	54	—10	27.0	4.16	.....
Milligan	60	— 2	31.4	5.52	6.0
Millport	55	— 9	27.2	4.46	12.5
Montpelier	45	3	25.5	3.57	11.5
Napoleon	52	3	27.8	3.52	17.0
New Alexandria	58	5	30.6	5.00	17.0
New Berlin	53	— 2	27.4	3.82	8.5
New Bremen	49	— 1	26.1	2.84	.....
New Lexington	.....	.....	.....	5.01	6.0
New Richmond	62	2	33.6	5.10	5.0
New Waterford	55	— 2	28.6	6.11	21.5
North Lewisburg	52	— 6	28.3	3.80	6.0
North Royalton[c]	53	4	27.0	.....	.....
Norwalk	48	5	27.2	3.64	14.5
Oberlin	56	— 2	29.0	3.17	10.0
Ohio State University	61	— 7	29.5	3.58	9.2
Orangeville	55	—11	27.0	3.55	21.0
Ottawa	49	2	26.7	2.80	15.8
Pataskala	55	— 9	29.4	4.83	10.8
Philo	58	6	31.0	4.99	9.1
Plattsburg	54	0	29.4	3.70	8.0
Pomeroy	61	14	35.5	3.26	4.2
Portsmouth *a*	.....	.....	.....	7.19	4.0
Portsmouth *b*	63	10	36.2	5.27	4.5
Pulse	.....	.....	.....	5.17	9.0
Redlion	.....	.....	.....	3.52	.....
Richfield	.....	.....	.....	3.98	10.5
Richwood	55	— 4	29.2	3.06	3.2
Ripley	63	3	32.6	5.48	3.2
Rittman	53	— 8	28.0	3.63	9.5
Rockyridge	50	3	27.4	4.05	14.6
Shenandoah	53	1	27.2	3.23	4.7
Sidney	51	— 1	29.1	3.46	10.6
Somerset	59	7	33.2	3.11	12.6
Springfield	.....	.....	.....	3.66	.....
Strongsville	.....	.....	.....	2.81	10.0
Swanton	.....	.....	.....	2.76	6.0
Thurman	62	9	34.6	6.15	.....
Tiffin	48	5	28.2	2.87	13.0
Upper Sandusky[c]	54	1	29.8	.....	.....
Urbana	51	— 5	26.2	3.40	6.6
Vanwert	54	4	27.3	3.38	12.0
Vickery	52	3	27.8	2.35	9.8
Wadsworth	.....	.....	.....	3.38	.....
Walnut	.....	.....	.....	3.78	8.7
Warren	60	4	28.5	4.46	21.8
Warsaw	55	4	29.6	4.32	10.0
Wauseon	50	— 1	26.3	3.05	13.8
Waverly	61	4	34.0	5.00	7.1
Waynesville	57	— 6	29.6	3.84	5.5
Wellington	55	— 2	28.4	2.91	13.0
Williamstown	.....	.....	.....	2.35	.....
Willoughby	.....	.....	.....	3.48	15.0
Wooster	60	— 5	28.5	4.07	12.0
Zanesville	.....	.....	.....	4.78	11.0
Oklahoma.					
Burnett	71	14	38.4	2.06	2.0
Chandler	68	12	35.1	2.34	1.0
Cleo	70	12	35.6	T.	T.
Clifton	71	13	37.3	2.10	3.0
Cloud Chief	63	14	36.4	1.32	1.2
Fort Reno	68	16	35.8	2.55	2.5
Fort Sill	73	15	38.3	1.87	1.8
Guthrie	69	11	37.4	1.89	4.4
Hennessey	70	12	35.6	1.28	1.0
Jefferson	70	5	33.7	1.08	1.2
Jenkins	65	10	33.6	1.12	2.0
Kenton	71	4	35.8	0.50	5.0
Kingfisher	72	13	36.9	1.39	0.3
Newkirk	66	11	33.3	1.49	T.
Pawhuska	68	10	34.4	2.05	1.0
Perry	70	10	35.3	1.39	2.5
Sac and Fox Agency	70	19	36.4	2.05	2.0
Shawnee	70[e]	17[g]	36.2[g]	1.75	0.5
Stillwater	67	11	36.2	1.63	0.9
Taloga	60	12	36.0	0.34	
Temple	74	16	40.4	1.16	1.5
Ural	.....	.....	.....	1.17	0.7
Watonga	70	19	37.6	.....	T.
Weatherford	54[j]	15[j]	34.2[j]	1.34	1.8
Waukomis	71	12	36.0	1.25	T.
Oregon.					
Albany *b*	.....	.....	.....	10.48	
Alpha	59	22	41.4	20.56	
Arlington	60	24	34.8	1.37	5.0
Ashland	62	21	39.2	2.95	
Aurora[•1]	57	25	40.6	6.69	
Aurora (near)	55	21	39.3	10.57	T.
Bay City	59	28	42.8	26.47	
Bend	55	4	31.4	2.83	8.0
Beulah	48	— 3	25.9	2.29	18.2
Blackbutte	55	23	38.0	10.30	
Blalock	57	26	35.3	2.68	3.0
Brownsville[•1]	56	28	43.9	9.76	
Bullrun	.....	.....	.....	14.13	0.5
Cascade Locks	54	27	35.0	19.85	21.0
Comstock[•1]	52	26	39.8	10.33	
Coquille	.....	.....	.....	17.29	
Corvallis	55	24	40.2	9.92	
Dayville	61	15	38.0	2.32	4.5
Doraville	49	26	37.2	15.37	5.0
Ella	.....	.....	.....	1.60	10.0
Eugene	60	26	41.8	9.84	
Fairview	63	25	47.2	16.06	
Falls City	53	20	38.8	22.02	
Forestgrove	54	21	39.0	12.92	T.
Gardiner	68	29	47.6	19.15	
Glenora	53	24	37.8	29.97	4.0
Government Camp	50[i]	14[i]	31.3[i]	13.46	67.9
Grants Pass	65	24	39.7	7.43	0.5
Grass Valley	50	— 6	28.8	2.30	9.0
Heppner	57	18	34.2	3.06	8.5
Hood River (near)	51	20	32.8	10.57	33.5
Huntington	57	6	31.0	3.41	23.0
Jacksonville	64	20	38.1	5.43	1.0
Joseph	58	3	26.1	2.65	21.5
Junction City[•1]	62	30	44.4	10.66	
Kerby	63	21	39.6	18.41	3.0
Klamath Falls	60	6	33.3	3.20	T.
Lafayette[•1]	58	22	40.8	9.21	
Lagrande	56	9	32.8	3.04	17.5
Lakeview	.....	.....	.....	2.38	2.2
Lonerock	57	11	33.1	2.56	13.5
McKenzie Bridge	51	18	34.9	15.30	5.5
McMinnville	56	23	40.0	13.08	1.0
Merlin	52	26	42.0	8.59	T.
Monmouth *b*[•1]	54	28	40.2	11.15	
Monroe	58	24	40.6	15.07	
Mount Angel	58	23	39.7	10.62	
Nehalem	.....	.....	.....	25.58	
Newberg	56	20	39.3	10.94	T.
Newport	57	33	45.0	17.60	
Pendleton	58	22	35.3	1.57	
Pine	52	—15	23.8	4.91	48.0
Placer	.....	.....	.....	9.57	
Prineville	56	19	36.2	1.55	7.5
Riddles[•1]	60	28	42.4	7.42	
Salem *b*	56	19	41.3	7.49	
Sheridan[•1]	62	25	42.5	12.55	
Silverlake	54	0	32.0	2.16	3.0
Silverton[•1]	56	20	44.6	11.21	
Siskiyou[•1]	54	25	36.4	5.61	19.5
Sparta	46	8	28.2	.....	40.0
Springfield[•1]	48	29	40.2	5.60	
The Dalles	49	16	34.4	4.00	22.5
Toledo	60	29	43.9	16.54	
Umatilla	58	25	34.1	0.81	0.1
Vale	49	1	27.9	1.38	4.0
Wamic	51	10	30.4	7.27	38.2
Warm Spring	53	15	33.1	2.34	11.5
Weston	61	15	32.3	4.75	12.2
Williams	70	17	40.4	8.16	2.5
Pennsylvania.					
Aleppo	60	— 9	31.3	5.54	10.0
Altoona	53	4	28.0	5.37	.....
Athens	49	— 5	26.4	2.93	20.0
Beaver Dam	.....	.....	.....	4.29	8.1
Bellefonte	55	1	30.0	5.21	15.5
Brookville	.....	.....	.....	4.96	20.2
Browers	.....	.....	.....	7.20	.....
California	62	12	34.9	4.33	11.5
Cassandra	52	6	27.2	4.16	2.2
Centerhall	52	0	28.2	.....	13.0
Clarion	.....	.....	.....	5.99	20.0
Coatesville	60	8	31.3	7.73	10.0
Confluence	.....	.....	.....	6.23	14.8
Davis Island Dam	.....	.....	.....	3.68	9.1
Derry Station	68	4	30.7	4.86	15.5
Doylestown	.....	.....	.....	7.94	.....
Driftwood	.....	.....	.....	3.47	.....
Dushore	48	—11	23.8	4.65	27.1
Dyberry	47	—10	22.3	5.84	32.0
East Bloomsburg	.....	.....	.....	3.48	.....
East Mauch Chunk	53	2	28.1	7.90	23.0
Easton	56	7	28.0	7.22	11.8
Ellwood Junction	.....	.....	.....	4.21	17.4
Emporium	52	— 3	27.0	5.00	20.2
Ephrata	55	8	29.3	6.17	12.0
Everett	58[d]	1[d]	28.2[d]	3.83	11.0
Forks of Neshaminy	.....	.....	.....	6.69	.....
Franklin	55	— 5	25.9	3.57	13.0
Freeport	.....	.....	.....	5.78	13.6
Girardville	.....	.....	.....	7.04	27.8
Greensboro	.....	.....	.....	5.02	14.0
Hamburg	53	2	29.2	6.64	10.0
Hamlinton	.....	.....	.....	4.09	16.8
Herrs Island Dam	.....	.....	.....	4.52	9.0
Huntingdon *a*	.....	.....	.....	5.03	20.0
Huntingdon *b*	60	3	29.8	5.50	17.5
Irwin	58	7	30.2	4.38	10.1
Johnstown	55	6	30.8	6.11	21.0
Kennett Square	60	8	31.5	6.67	9.0
Lansdale	.....	.....	.....	6.45	.....
Lawrenceville	54	—12	24.2	3.21	24.2
Lebanon	52	3	28.4	7.46	12.5
Leroy	48	0	24.4	3.46	21.8
Lewisburg	55	— 4	26.6	4.96	19.0
Lockhaven *a*	53	5	28.6	4.27	22.0
Lockhaven *b*	.....	.....	.....	4.40	.....
Lock No. 4	.....	.....	.....	3.96	4.2
Lycippus	51[g]	8[g]	30.6[g]	5.17	26.8
Mifflin	.....	.....	.....	4.22	.....
Oil City	.....	.....	.....	4.80	20.2
Ottsville	.....	.....	.....	7.49	.....
Parker	.....	.....	.....	5.56	16.8
Philadelphia	58	17	34.0	8.11	5.9
Pocono Lake	50	— 9	23.5	2.66	.....
Point Pleasant	.....	.....	.....	7.03	.....
Pottsville	.....	.....	.....	7.80	.....
Quakertown	57	4	29.2	8.06	14.0
Reading[g]	.....	.....	29.0	7.10	.....
Renovo *a*	53	6	28.3	4.55	22.7
Renovo *b*	.....	.....	.....	3.75	.....
Saegerstown	53	—11	26.2	4.11	23.8
St. Marys	48	— 2	23.2	.....	.....
Saltsburg	.....	.....	.....	4.69	15.4
Selsholtzville	.....	.....	.....	8.51	.....
Selinsgrove	56	0	28.4	4.26	11.0
Shawmont	.....	.....	.....	6.39	.....
Smethport	50	— 3	24.2	.....	.....
Smiths Corners	.....	.....	.....	6.57	.....
Somerset	55	4	26.9	6.81	22.8
South Bethlehem	52	7	29.0	8.39	19.0
South Eaton	53	1	26.9	6.09	20.0
Spring Mount	.....	.....	.....	6.35	.....
State College	52	9	27.2	4.82	13.3
Sunbury	.....	.....	.....	2.60	13.0
Towanda	48	— 6	25.8	2.95	18.0
Troutrun	.....	.....	.....	3.50	21.0
Uniontown	56	13	34.6	4.75	19.5
Warren	52	0	25.8	4.57	24.0
Wellsboro	52	— 2	27.3	5.18	25.0
Westchester	58	12	31.2	7.95	6.0
West Newton	.....	.....	.....	6.02	8.0
Wilkesbarre	59	6	29.2	4.95	27.4
Williamsport	57	9	29.0	3.74	16.5
York	66	5	30.0	6.15	14.6
Rhode Island.					
Bristol	52	— 5	30.6	6.29	21.5
Kingston	54	—12	27.2	8.03	26.0
Narragansett	54	— 5	29.4	6.37	26.5
Pawtucket	55	— 4	29.0	5.62	18.2
Providence *a*	57	— 6	30.0	6.40	23.5
Providence *c*	53	—10	27.9	6.00	23.0
South Carolina.					
Aiken	72	14	48.4	5.10	
Allendale	72	19	48.8	3.75	
Anderson	70	14	44.8	4.32	
Barksdale[1]	68	14	48.6	4.50	
Batesburg	69	11	46.1	5.34	T.
Beaufort	75	24	53.6	4.49	
Bennettsville	72	17	47.5	1.92	
Blackville	73	17	47.5	4.82	
Bowman	75	17	51.5	3.33	
Calhoun Falls	.....	.....	.....	5.82	
Camden	.....	.....	.....	4.28	
Cheraw *a*	73	17	44.6	4.57	
Cheraw *b*	.....	.....	.....	4.59	
Clarks Hill	70	15	47.4	2.87	T.
Clemson College	70	11	41.4	5.22	
Conway	72	18	47.8	6.80	
Darlington	73	16	46.3	2.58	
Duewest	66	17	46.4	5.13	
Effingham	.....	.....	.....	4.59	
Florence	72	19	46.8	4.59	
Gaffney	67	16	42.3	5.60	
Georgetown	71	20	49.6	5.60	
Gillisonville	75	11	50.4	5.35	
Greenville	68	14	40.6	6.38	
Greenwood	68	17	43.0	6.06	
Heath Springs	65	14	42.0	2.65	
Kingstree *b*	.....	.....	.....	5.71	
Liberty	69	12	42.7	5.86	T.
Little Mountain	69	15	46.2	3.29	T.
Longshore	69	15	45.2	3.60	T.
Pinopolis[•1]	70	20	52.0	4.77	
St. Stephens	.....	.....	.....	5.40	
Saluda	68[c]	16[c]	45.0[c]	2.86	T.
Santuck	70	14	44.0	3.54	
Seivern	85	11	48.6	4.48	T.
Smiths Mills	.....	.....	.....	5.25	
Society Hill	71	18	45.4	2.21	
Spartanburg	69	15	42.0	4.68	
Statesburg	73	17	48.8	2.97	
Summerville	75	18	49.9	4.22	
Temperance	71[d]	21[d]	45.8[d]	2.57	
Trenton	72[c]	16[c]	46.6[c]	4.01	T.
Trial	75	10	51.3	3.55	
Winnsboro	74	15	43.4	2.74	
Winthrop College	66	15	43.3	3.67	
Yorkville	67	18	44.8	4.44	
South Dakota.					
Aberdeen	34	—27	8.2	4.80	17.0
Academy	49	—20	15.8	2.53	26.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Alexandria	45	−26	12.0	2.45	13.5
Armour	55	−24	12.5	2.75	25.0
Ashcroft	51	−18	17.8	0.25	2.5
Bowdle	51	−27	9.2	1.15	.....
Brookings	41	−28	10.6	2.52	12.0
Canton	47	−17	16.0	1.16	14.0
Centerville	.....	.....	.....	1.80	11.1
Chamberlain	44	−21	14.8	1.49	17.6
Clark	46	−29	11.9	1.50	12.5
Doland	43	−28	10.7	2.05	13.2
Elkpoint	45	−15	17.6	2.89	21.2
Fairfax	50	−18	15.6	.....	.....
Farmingdale	.....	.....	.....	0.43	5.5
Faulkton	46	−23	11.6	1.49	13.5
Flandreau	40	−24	11.6	1.95	12.0
Forestburg	42	−30	9.8	1.53	16.3
Fort Meade	70[h]	−12	24.6[e]	0.67	1.5
Gannvalley	41	−20	13.1	2.15	20.5
Gary	40	−26	10.4	1.77	24.0
Gettysburg	42	−19	11.4	0.84	11.6
Grand River School	53	−16	15.8	0.06	1.5
Greenwood	51	−18	18.4	2.50	20.3
Highmore	.....	.....	.....	1.10	11.0
Hotch City	41	−18	13.8	1.12	17.5
Howell	43	−27	11.6	1.52	8.1
Ipswich	47	−31	10.5	1.10	8.0
Kimball	45	−24	14.6	2.06	17.5
Leola	40	−35	8.4	1.09	10.0
Leslie	54	−20	13.4	1.97	14.2
Marion	47	−29	15.0	2.10	10.0
Mellette	41	−30	11.7	1.11	9.0
Menno	59	−19	13.6	1.99	13.8
Millbank	50	−30	13.3	1.50	11.0
Mitchell	46	−25	13.1	2.12	14.5
Oelrichs	45	− 9	20.2	1.41	14.1
Pedro	54	−20	13.9	1.33	15.0
Pine Ridge	50[m]	− 6	21.8[g]	0.88	17.5
Plankinton	44	−23	14.8	1.68	16.0
Ramsey	42	−22	11.4	1.70	9.5
Redfield	41	−30	10.1	1.27	9.0
Rosebud	48	− 9	18.4	1.90	21.8
Silver City	.....	.....	.....	1.20	12.0
Sioux Falls	43	−20	13.8	1.66	12.0
Sisseton Agency	39	−26	11.6	1.68	16.8
Spearfish	61	− 8	25.6	1.87	20.0
Tyndall	50	−25	15.8	1.22	.....
Vermilion	40	−18	15.6	1.71	15.0
Watertown	42	−26	9.8	1.05	10.5
Waubay	35	−26	9.4	1.15	8.1
Wentworth	40	−24	10.6	2.19	15.7
Wolsey	.....	.....	.....	2.07	18.2
Tennessee.					
Andersonville	62	14	39.0	4.92	T.
Ashwood	67	10	40.0	4.71	.....
Benton	70	15	41.6	3.97	T.
Bluff City	.....	.....	.....	2.64	T.
Bolivar	65	12	40.2	10.41	.....
Bristol	60	11	36.2	2.11	T.
Byrdstown	64	13	38.4	6.34	1.2
Carthage	65	15	38.6	6.05	0.3
Charleston	.....	.....	.....	4.58	T.
Clarksville	66	11	38.8	9.45	1.0
Clinton	.....	.....	.....	4.32	T.
Covington	64	13	41.4	6.40	.....
Decatur	68	12	40.9	6.44	0.5
Dickson	66	9	39.6	10.10	.....
Dover	65	12	38.3	7.54	.....
Elizabethton	66	13	38.0	1.57	0.1
Erasmus	63	8	37.4	5.33	1.4
Florence	66	10	40.0	5.53	T.
Franklin	65	11	40.0	7.53	2.5
Grace[s1]	70	16	40.8	5.70	.....
Greeneville	64	11	38.8	1.80	0.1
Hohenwald	67	5	38.6	9.49	3.5
Iron City	67	7	40.0	7.71	.....
Isabella	66	13	39.2	4.73	T.
Jackson	68	10	41.5	9.06	.....
Johnsonville	63[t]	8[t]	39.0[t]	9.96	T.
Jonesboro[s1]	61	19	40.5	2.12	3.1
Kenton[s5]	68	12	38.4	10.53	T.
Kingston	.....	.....	.....	5.08	.....
Leadvale	.....	.....	.....	2.26	T.
Lebanon	67	15	40.6	3.52	.....
Lewisburg	68	9	39.9	5.22	0.5
Liberty	65[s]	5[s]	39.6[s]	5.27	T.
Lynnville	65	10	40.6	5.28	T.
McKenzie	65	10	39.0	9.40	T.
McMinnville	67	14	39.5	4.62	0.4
Maryville	66	14	41.2	4.12	T.
Newport	63	15	39.8	2.19	T.
Nunnelly	67	6	38.8	7.35	.....
Oakhill	63	11	38.8	2.80	.....
Palmetto	72	9	40.7	4.68	.....
Pope	72	5	40.6	9.90	T.
Rogersville	64	15	39.3	2.66	T.
Rugby	62	10	36.2	6.52	T.
Savannah	68	10	41.6	10.44	T.
Sewanee	63	9	37.8	3.57	T.
Tennessee—Cont'd.					
Silverlake	57	9	35.7	2.91	15.3
Springdale	73	15	40.4	3.52	T.
Springville	66	11	40.0	8.91	T.
Tazewell	.....	.....	.....	4.71	1.5
Tellico Plains	69	14	43.0	3.92	T.
Tracy City	63	10	37.2	4.71	0.8
Trenton	67	12	40.4	10.19	T.
Union City	65	11	39.4	8.48	T.
Waynesboro	66	6	39.6	7.60	1.0
Wildersville	67	13	41.7	9.64	.....
Yukon	66[r]	9[r]	41.1[r]	5.91	.....
Texas.					
Albany	70	26	43.7	1.55	T.
Alvin	.....	.....	.....	3.42	.....
Anna	73	20	43.4	1.60	T.
Anson	.....	.....	.....	0.55	T.
Arthur	.....	.....	.....	3.10	.....
Austin[a]	78	30	50.6	4.20	.....
Ballinger	72	24	45.7	0.24	0.3
Bastrop[k]	78	31	54.6	3.55	.....
Beaumont	78	32	53.5	2.43	.....
Beeville	81	34	57.3	2.68	.....
Bigspring	75	19	43.7	0.34	T.
Blanco	76	25	50.2	2.36	.....
Boerne[s1]	71	28	27.7	3.65	.....
Booth	.....	.....	.....	2.69	.....
Bowie	72	17	41.7	1.60	0.8
Brazoria	81	32	57.4	3.46	.....
Brenham	76	31	52.8	1.70	.....
Brighton	77	32	59.7	3.42	.....
Burnet	75	25	47.6	2.24	.....
Camp Eagle Pass	80	27	55.4	3.00	.....
Childress	74	19	40.0	0.76	2.0
Coleman	81	24	47.8	0.65	T.
College Station	78	26	52.0	1.15	.....
Colorado	76	17	42.6	0.17	T.
Columbia	79	32	56.8	3.69	.....
Comanche	77[d]	22[d]	47.0[d]	0.66	T.
Corsicana	75	26	49.6	2.39	T.
Cotulla	76	33	55.0	2.25	.....
Cuero	78	34	57.1	1.26	.....
Dallas	77	23	44.8	1.82	1.2
Danevang	80	31	56.0	5.55	.....
Dublin	74	24	44.3	0.70	.....
Duval	83	31	51.8	3.57	.....
Estelle	76	22	45.0	1.54	2.0
Fort Clark	72	27	48.0	2.75	.....
Fort Davis	71	18	45.2	T.	T.
Fort McIntosh	80	36	59.2	1.84	.....
Fort Ringgold	86	37	62.8	0.00	.....
Fredericksburg	75[s]	27[f]	48.6[f]	1.77	.....
Gainesville	69	19	41.2	2.14	1.0
Gatesville	75	26	49.4	1.62	T.
Georgetown	80	26	52.5	3.11	.....
Grapevine	75	21	45.0	1.35	1.5
Greenville	74	23[d]	42.7	2.90	T.
Hale Center	72	19	45.2	1.25	0.2
Hallettsville	78	32	55.8	2.41	.....
Haskell	77	21	42.6	0.82	0.5
Henrietta	75	17	41.5	1.24	0.2
Hewitt	.....	.....	.....	1.77	.....
Hondo	.....	.....	.....	3.39	.....
Houston	79	33	53.9	2.38	.....
Huntsville	75	30	51.2	2.15	.....
Ira	78	17	45.0	0.48	2.0
Jacksonville	72	26	50.4	2.01	T.
Jasper	80	29	57.0	3.64	.....
Junction	.....	.....	.....	2.42	.....
Kaufman	73	24	46.8	2.79	1.0
Kent	.....	.....	.....	0.40	1.5
Kerrville	85	24	51.4	2.80	.....
Kopperl	.....	.....	.....	1.02	.....
Lampasas	77	24	47.2	1.88	.....
Lapara	.....	.....	.....	0.45	.....
Laureles Ranch	.....	.....	.....	3.33	.....
Llano	76	30	49.0	2.50	.....
Longview	71	27	47.1	4.00	0.5
Luling	77	30	51.2	3.15	.....
Mann	76	26	49.1	2.43	T.
Marlin	76	29	48.6	2.98	.....
Menardville	76	19	45.9	1.07	.....
Mount Blanco	73	11	40.3	0.20	2.0
Nacogdoches	77	25	48.5	2.04	T.
New Braunfels	75[d]	31[d]	54.0[d]	2.31	.....
Panter	.....	.....	.....	1.38	.....
Paris[a]	75	21	44.8	3.45	.....
Pearsall	75	30	54.2	2.55	.....
Rhineland	75	14	43.3	0.80	T.
Rockisland	78	33	54.0	2.55	.....
Rockport	72	43	59.8	2.65	.....
Runge	79	31	54.1	4.31	.....
Sanderson	66	25	46.6	T.	.....
San Marcos	75	28	52.6	0.00	.....
San Saba	75	23	48.8	1.31	.....
Santa Gertrude Ranch	.....	.....	.....	3.19	.....
Shaeffer Ranch	88	32	57.8	1.84	.....
Sherman	71	23	44.2	1.82	T.
Sonora	74	23	47.6	0.23	T.
Texas—Cont'd.					
Sugarland	83	30	56.2	2.86	.....
Sulphur Springs	72	24	45.6	2.98	0.2
Temple[a]	74	28	46.0	3.22	.....
Temple[b]	74	28	46.2	2.95	.....
Trinity	77	27	52.6	1.81	.....
Tulia	75	12	38.2	0.70	2.0
Tyler	73	27	47.4	2.99	.....
Victoria	80[h]	35[h]	58.0[h]	4.10	.....
Waco	78	29	49.4	1.95	.....
Weatherford	74	22	44.0	1.07	1.0
Wichita Falls	.....	.....	.....	1.45	.....
Utah.					
Alpine	.....	.....	.....	0.80	3.0
Aneth	55	− 2	26.0	1.09	.....
Blackrock	54	− 3	28.2	0.45	5.0
Bluecreek[s1]	55	7	32.6	1.42	4.0
Callao	66	0	32.4	0.28	3.0
Castledale	48	− 8	21.6	0.10	.....
Cisco	48	0	23.0	0.40	4.0
Corinne	52	10	30.9	1.97	6.0
Coyoto	48	−20	18.5	0.80	8.0
Deseret	60	2	30.0	0.20	2.0
Emery	45	3	24.6	T.	.....
Farmington	57	12	31.4	1.92	19.1
Fillmore	69	9	33.6	0.46	.....
Frisco	57	− 8	31.7	0.39	5.0
Giles	53	−11	19.0	0.29	2.9
Government Creek	53	5	30.2	0.72	6.5
Green River	51	−15	17.6	0.52	5.2
Grover	53	− 2	25.4	0.30	3.0
Heber	50	− 6	24.4	1.04	.....
Henefer	54	−15	22.4	1.61	11.2
Hite	66	7	33.2	0.20	T.
Huntsville	.....	.....	.....	2.07	13.0
Kanab	.....	.....	.....	1.37	.....
Kelton	43	2	23.9	0.30	3.0
La Sal	55	0	26.6	.....	.....
Levan	50	3	26.	1.72	13.5
Loa	47	−25[e]	14.0[e]	0.65	6.0
Manti	54	0	25.5	0.86	7.0
Marysvale	56	− 8	25.6	0.63	6.5
Meadowville	48	3	24.6	1.30	5.0
Millville	.....	.....	.....	1.58	.....
Minersville	59	7	30.6	.....	.....
Moab	53	3	28.7	0.40	3.0
Monticello	39	5	22.6	0.49	6.3
Mount Nebo	58	7	27.0	1.25	.....
Mount Pleasant	48[t]	3[t]	24.9[t]	1.32	10.0
Ogden[a]	53	9	31.2	1.96	6.5
Parowan	56	2	29.0	1.03	10.3
Pinto	59[e]	− 9[e]	26.4[e]	0.70	.....
Plateau	52	−20	22.2	1.35	19.9
Provo	60	7	32.8	1.28	.....
Ranch	55	−10	23.3	1.66	16.6
Richfield	59	2	29.4	0.47	4.7
St. George	64	8	36.5	0.39	T.
Scipio	59	0	30.9	0.47	T.
Snowville	50	− 5	25.4	0.90	.....
Thistle	53	− 3	26.6	1.45	8.0
Tooele	57	12	32.2	0.58	.....
Tropic	49	−13	20.8	0.46	11.0
Vernal	50	− 9	20.0	0.97	4.8
Wellington	49	− 7	24.2	0.25	2.5
Woodruff	57	−20	16.5	0.20	2.0
Vermont.					
Bellows Falls	.....	.....	.....	5.38	22.0
Burlington	42	−10	22.2	1.62	8.5
Chelsea	41	−20	16.3	3.87	28.0
Cornwall	48	−16	21.4	1.44	9.0
Enosburg Falls	45	−20	15.8	2.40	20.0
Hartland	48	−20	18.6	5.48	34.0
Jacksonville	40	−24	20.6	2.82	.....
Manchester	45	−22	20.6	5.30	26.6
Morrisville	44	−22	16.9	6.71	24.4
Newport	43	−26	14.9	2.18	18.1
St. Johnsbury	46	−22	16.8	2.49	27.5
Wells	46	−25	19.2	3.80	16.5
Wells River	.....	.....	.....	3.10	21.0
White River Junction	.....	.....	.....	4.45	28.0
Woodstock	48	−16	19.6	4.99	40.5
Virginia.					
Alexandria	58	16	35.2	5.08	1.9
Ashland	65	17	36.6	5.74	0.2
Barboursville	69[s]	15[s]	41.4[s]	4.25	2.0
Bedford	65	12	38.1	2.86	T.
Blacksburg	71	9	35.2	2.43	0.5
Bluemont	58	14	34.5	4.20	5.0
Boykins	72	20	45.2	3.00	.....
Bonair	67	16	38.0	4.80	0.2
Buckingham	70	10	39.0	2.86	T.
Burkes Garden	54	3	32.2	4.15	3.0
Callaville	66	18	46.4	4.14	0.5
Charlottesville	67	16	36.9	4.20	1.5
Clarksville	.....	.....	.....	4.43	T.
Columbia	68	7	35.2	3.50	T.
Dale Enterprise	67	9	34.4	3.45	4.5
Danville	.....	.....	.....	4.14	T.
Farmville	63	16	38.8	3.90	.....

TABLE II.—*Climatological record of voluntary and other cooperating observers*— Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fredericksburg	63	15	36.3	4.47	T.
Grahams Forge [k]	59	14	38.8	3.20	2.6
Hampton	67	21	43.2	3.21	0.5
Hot Springs [m]	58	12	36.0	3.00	4.0
La Crosse	68	13	40.8	3.20	T.
Lexington	66	14	36.8	2.71	1.8
Lincoln	56	12	33.0	4.17	2.0
Manassas	56	13	34.2	4.44	2.0
Mendota				3.58	T.
Newport News	68	15	42.6	3.80	T.
Petersburg	68	17	40.0	3.32	T.
Radford				2.82	3.0
Riverton				4.39	4.0
Rockymount	58	14	35.0	5.41	T.
Saxe	65	13	38.8	3.65	T.
Shenandoah				2.27	1.2
Speers Ferry				3.84	T.
Spottsville	67	14	40.9	4.32	0.5
Staunton	67	15	36.8	3.58	3.0
Warsaw	65	11	37.4	4.16	1.0
Wilkerson	66	15	37.5	5.32	T.
Williamsburg	63	12	40.5	3.07	1.0
Woodstock	65	13	33.2	3.93	5.0
Wytheville	68	10	36.2	2.42	3.5
Washington.					
Aberdeen	47	29	38.0	18.95	T.
Anacortes				3.44	
Ashford				15.20	19.0
Blaine	59	23	39.0	6.56	3.0
Bremerton	52	27	38.4	13.01	10.0
Cedonia	43	8	25.2	2.43	16.1
Centralia	61	30	40.5	11.55	1.5
Cheney				3.18	20.0
Clearwater	54	30	39.8	20.15	2.5
Cle Elum	43	3	25.2	7.77	65.5
Colfax	49	19	33.0	3.04	5.0
Colville	45	6	28.0	3.10	21.0
Conconully	44	3	22.9	2.45	23.3
Coupeville	55	29	40.9	2.89	0.5
Crescent	44	12	27.5	2.83	18.0
East Sound	55	16	35.8	6.52	T.
Ellensburg	44	1	23.5	3.24	32.2
Ellensburg (near)	42	2	23.4	3.40	32.0
Grandmound	55	28	39.8	14.94	3.0
Granite Falls				10.93	7.5
Hilburn	52	29	38.4	22.45	1.2
Hooper	53	22	33.6	2.91	3.3
Ilwaco	54	29	42.2	17.61	T.
Lacenter	55	22	37.8	12.32	
Lakeside	46	14	26.2	3.98	36.0
Lind	46	17	30.4	2.49	15.5
Loomis	45	9	24.0	2.70	21.0
Mayfield	53[d]	28[d]	38.6[d]	14.87	
Mottinger Ranch	50	25	34.8	1.01	1.5
Mount Pleasant	45	27	35.8	11.39	4.4
Moxee	48	3	27.0	1.89	13.7
Olga	55	32	41.6	6.69	
Olympia	56	30	40.8	14.04	2.0
Pinehill	50	14	32.0	7.72	40.4
Pomeroy	59	18	33.6	2.82	5.0
Port Townsend	53	31	41.4	3.10	
Pullman	48	13	31.2	2.92	13.0
Rattlesnake Mountains	47	11	28.4	2.14	9.5
Republic	64	4	24.3	2.75	15.6
Ritzville				1.06	7.4
Rosalia	50	15	30.4	3.00	16.0
Sedro	59	25	39.3	6.62	T.
Silvana	56	27	40.2	4.74	
Snohomish	51	26	39.0	7.45	
Snoqualmie	50	28	40.6	10.45	
Southbend	58	30	42.4	22.39	
Sprague				1.60	6.0
Stampede				8.35	78.0
Sunnyside	53	14	30.9	1.11	4.5
Trinidad	54	11	26.1	3.10	23.2
Union	52	29	39.0	21.36	4.5
Usk	40	8	28.3	3.49	26.8
Vancouver	55	20	39.4	11.13	0.5
Vashon	56	30	41.3	10.72	T.
Waterville	37	3	22.8	3.49	32.0
Wenatchee (near)	45	11	25.9	4.84	45.5
Whatcom	59	25	40.2	4.80	
Wilbur	43	4	24.4	2.35	15.2
Zindel	52	20	36.6	2.53	3.5
West Virginia.					
Addison	60	10	36.0	5.40	8.0
Bayard	59	0	29.6	6.21	15.8
Beverly	58	9	31.9	6.37	14.0
Buckhannon	60	10	33.5	6.23	12.0
Burlington	60	8	32.5	3.87	9.0
Byrne				8.10	23.0
Cairo	64	9	35.1	4.36	13.5
Camden	60	10	34.2	5.48	10.4
Central	62	9	33.4	5.64	11.0
Chapel	62	15	35.0	8.04	10.3
Charleston				5.49	3.5
Clay	70	4	33.2	3.83	4.8
Creston	58	10	35.0	6.53	7.5
Cuba	61	1	34.6	5.81	5.0
Dayton	63	8	33.5	6.88	10.5
Echo	65	12	37.6	7.60	2.0
Elkhorn	62	10	38.6	2.72	4.4
Fairmont				6.74	15.4
Glenville	65	11	33.4	7.29	9.8
Grafton	61	9	33.4	6.86	16.0
Green Sulphur	65	9	32.2	2.01	
Hinton [b]	65	13	36.7	3.30	3.6
Huntington	61	13	35.3	6.46	2.0
Josiah	61	9	32.8	6.64	11.0
Leonard	55	5	30.1	4.56	6.0
Lewisburg	55	8	32.9	3.94	3.0
Lillydale	62	11	36.2	2.69	3.3
Logan	66	15	40.3	5.77	2.0
Magnolia	60	5	31.1	3.95	8.0
Martinsburg	59	9	30.8	3.25	7.0
Morgantown	60	9	33.2	6.12	17.0
Moscow	58	1	30.3	2.95	12.0
Nuttallburg	62	13	38.4	3.95	10.0
Oceana	63	13	37.4	5.57	
Oldfields	65	6	33.5	4.80	7.5
Philippi	61	7	33.4	7.34	15.8
Pickens	57	4	31.6	9.95	33.5
Point Pleasant	63	10	32.5	6.38	3.0
Princeton	59	16	36.0	4.30	10.5
Romney	58	8	33.2	3.87	11.0
Rowlesburg				7.91	17.0
Ryan	64	12	36.0	6.17	7.0
Southside	62	16	36.6	6.43	4.0
Terra Alta	54	— 1	28.6	8.85	18.0
Travellers Repose	55[d]	— 2[d]	30.1[d]	3.91	11.0
Uppertract	63	9	35.2	3.14	6.0
Wellsburg	56	5	30.0	5.11	17.0
Weston *a*				7.34	13.4
Weston *b*	65	10	36.4		
Wheeling *a*				5.38	12.0
Wheeling *b*	62	11	35.2	4.71	
Williamson	70	12	37.4	4.28	0.5
Wisconsin.					
Amherst	43			2.47	15.0
Appleton	44	— 6	19.9	2.81	15.6
Ashland				1.76	9.4
Barron				1.37	12.7
Bayfield	36	— 5	17.6	2.04	
Beloit	47	—13	18.8	2.04	T.
Brodhead	52[e]	—10	21.0[e]	2.81	8.0
Butternut [f]	39	—20	13.0	1.51	15.1
Chilton	41	—15	18.4	3.18	13.5
Darlington	42	—18	16.8	1.91	8.0
Dodgeville	50	—11	18.2	1.80	18.0
Downing	42	—20	15.9	3.61	22.0
Easton	44	—15	18.3	2.34	11.5
Eau Claire	40	—15	17.2	3.05	19.0
Florence	38[d]	— 5	18.1	1.68	13.0
Fond du Lac	42	— 6	23.5	1.62	0.5
Grand River Locks				2.38	9.0
Grantsburg	37	—23	13.4	2.68	19.0
Hancock	39	—12	18.2	1.82	12.7
Harvey	41	— 7	21.2	1.94	8.8
Hayward	38	—18	15.0	2.33	20.2
Hillsboro	42	—19	17.0	2.85	19.0
Koepenick	42	—18	17.8	1.60	16.0
Ladysmith	37	—15	15.4	2.36	21.2
Lancaster	43	—15	18.4	1.91	10.0
Madison	40	— 5	20.7	1.84	5.8
Manitowoc	42	— 2	24.6	2.43	7.0
Meadow Valley	43	—14	17.6	1.66	10.0
Medford	42	—13	18.2	0.70	7.0
Menasha				1.88	8.0
Neillsville	40	—12	17.6	3.05	12.0
New Holstein	41	— 8	20.1	2.90	10.0
New London	40	— 8	19.4	2.38	8.0
North Crandon	38	—10	17.0	0.65	6.5
Oconto	41	— 9	21.8	2.50	17.5
Osceola	38	—28	13.8	2.11	23.3
Oshkosh	41[e]	—16	21.4	1.54	6.0
Pine River	39	—12	18.0	2.49	14.0
Portage	43	— 7	21.0	2.39	9.0
Port Washington	50	— 3	23.2	3.20	4.0
Prairie du Chien *a*	60	— 9	23.8	3.37	9.8
Prentice	38	—13	14.5	2.80	28.0
Racine	48	— 1	25.8	2.20	
Sheboygan	43	— 1	25.7	1.96	4.5
Spooner	40	—20	12.2	1.77	13.9
Stevens Point	40	—12	18.2	2.27	7.0
Tomahawk	40	—16	15.4		
Valley Junction	41	— 8	19.8	1.96	7.0
Viroqua	40	—14	16.8	3.10	20.0
Watertown	41	— 7	20.2	1.74	7.2
Waukesha	41	— 6	22.4	2.31	10.2
Waupaca	39	—10	18.7	2.17	9.2
Wausau	39	—10	19.2	2.29	
Whitehall	43	—18	16.4	3.35	22.8
Wyoming.					
Alcova	53	4	28.0	1.07	22.2
Basin	47	— 6	20.4	T.	T.
Bedford	48	—19	17.6	1.92	19.2
Border	45	—35	9.2	0.90	7.9
Buffalo	56	— 6	25.2	0.25	2.5
Centennial	55	—15	26.0	1.38	
Chugwater	60	1	28.6	1.75	17.5
Daniel	46	—23	14.2	1.55	15.5
Evanston	50	—12	20.8	0.84	6.5
Fort Laramie	62	— 3	27.0	0.68	11.5
Fort Washakie	63	— 5	23.1	0.05	0.5
Fort Yellowstone	45	— 5	22.8	0.85	8.5
Fourbear	55	— 5	26.0	0.33	5.7
Griggs	57	—15	23.5	1.19	12.0
Hyattville	60	— 3	27.7	0.50	5.0
Irma	60	0	31.0	0.90	9.0
Iron Mountain	54	3	28.8	0.50	
La Grange	55[e]	1[e]	26.3[e]	1.43	14.3
Laramie	52	— 8	24.0	0.89	11.5
Leo	46	—15	20.0	1.51	30.0
Lolabama Ranch	49	—15	20.8	0.63	8.0
Lusk	47	— 5	20.6	1.32	13.2
Moore	57	9	28.8	1.08	26.2
Pinebluff	57	1	26.1	1.80	18.0
Rawlins	52	— 8	24.2	2.11	21.1
Rocksprings		—16		0.24	2.5
Saratoga	56	— 9	24.8	1.40	14.0
South Pass City	42	—13	13.8	0.40	4.0
Thermopolis	63	—13	25.0	0.30	3.0
Wheatland	54	6	25.3		
Porto Rico.					
Adjuntas	90	54	70.4	6.93	
Aguadilla	90	63	76.4	4.02	
Aguirre	88	64	77.5	2.40	
Arecibo	87	59	73.5	5.50	
Barros	85	53	69.7	2.20	
Caguas	92	57	72.4	4.25	
Canovanas	86	68	77.4	6.59	
Cayey	91	59	74.2	3.31	
Cidra	89	55	72.3	7.80	
Carozal [r]	92	55	73.1	7.15	
Guanica	86	66	76.7	4.47	
Guayama	91	61	77.0	3.58	
Hacienda Coloso				1.59	
Hacienda Perla	89	60	74.6	3.72	
Humacao	90	67	76.6	12.01	
Isabela	88	72	79.5	4.29	
Juana Diaz	85	64	74.6	7.07	
La Isolina	91	64	77.6	3.27	
Las Marias	88[k]	62[k]	74.3[k]	7.46	
Manati	90	64	76.2	8.93	
Maunabo	91	62	75.4	4.45	
Mayaguez	87	65	76.7	5.30	
Morovis	90	62	75.8	4.48	
Ponce	89	59	74.7	1.96	
Rio Piedras	89	65	76.6	2.25	
San German				5.76	
San Lorenzo	88	65	76.0	12.34	
San Salvador	89	59	73.9	6.46	
Santa Isabel	85	61	71.2	7.20	
Utuado	87	64	76.0	5.34	
Yauco	89	60	74.6	4.58	
Mexico.	85	65	75.0	3.74	
Ciudad P. Diaz	71	33	52.4	2.60	
Coatzacoalcos	88	55	71.8	9.69	
Leon de Aldamas	75	38	56.8	0.80	
Vera Cruz	80	60	72.0		
New Brunswick.					
St. John	50	—14	21.2	6.88	34.3
Isthmus of Panama.					
Alhajuela	92	69	81.0	4.53	
La Boca	88	72	79.5	2.84	
West Indies.					
San Pedro de Macoris, S. D	88	62	74.8	4.67	

Late reports for November, 1902.

Alaska.	°	°	°	*Ins.*	*Ins.*
Copper Center	32	—46	—0.6		15.0
Fort Egbert	20	—52	—1.9	0.62	14.5
Fort Liscum	37	0	21.1	6.98	
Orca	42	11	30.9	11.10	46.0
Skagway	48	4	27.2	1.24	10.0
Wood Island	53[f]	11[f]	34.5[f]	1.00	6.0
California.					
Glendora				2.23	
Kernville				0.85	
Milo				2.53	
Mills College				3.44	
Newcastle	72	32	50.1	3.05	
San Miguel Island	69	42	55.2	3.14	
Colorado.					
Grover				0.00	
Illinois.					
Lagrange	71	21	45.6	2.68	T.

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Iowa.	°	°	°	*Ins.*	*Ins.*
Belle Plaine	71	20	42.5	3.13	6.0
Gilman				2.35	T.
Villisca	74	15	42.8	2.20	.....
Louisiana.					
Rayne	87	40	65.2	4.73	
Sugar Experiment Station	84	39	65.8	3.41	
Minnesota.					
Winnebago	67	11	36.6	2.26	1.0
Montana.					
Kipp	69	— 5	23.6	1.55	15.5
New Jersey.					
Hanover	69	22	47.0	0.96	
Ohio.					
Bloomingburg				2.37	
Oregon.					
Government Camp	49	15	34.2	18.13	66.0
Placer				7.78	
Texas.					
San Marcos	82	32	63.6	5.87	
Nicaragua.					
Nandaime	89	74	81.8	0.68	

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "a" denotes 14 days missing.

CORRECTIONS.

November, 1902, Iowa, Idagrove, strike out precipitation 0.21 and snowfall 1.0.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of December, 1902.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	27	9	7	33	n. 55 w.	32
Portland, Me	28	15	4	31	n. 64 w.	30
Concord, N. H	14	6	7	12	n. 32 w.	9
Northfield, Vt	19	35	3	14	s. 34 w.	19
Boston, Mass	23	10	5	36	n. 67 w.	34
Nantucket, Mass	22	5	11	32	n. 51 w.	27
Block Island, R. I	26	10	13	27	n. 41 w.	21
New Haven, Conn	33	9	5	29	n. 45 w.	34
Middle Atlantic States.						
Albany, N. Y	27	20	4	24	n. 71 w.	21
Binghamton, N. Y.†	13	5	8	14	n. 37 w.	10
New York, N. Y	23	6	10	38	n. 59 w.	33
Harrisburg, Pa	18	9	18	25	n. 38 w.	11
Philadelphia, Pa	26	11	12	28	n. 43 w.	22
Scranton, Pa	22	18	13	25	n. 72 w.	13
Atlantic City, N. J	30	9	10	31	n. 45 w.	30
Cape May, N. J	27	10	9	29	n. 50 w.	26
Baltimore, Md	24	14	8	28	n. 63 w.	22
Washington, D. C	25	21	6	21	n. 75 w.	16
Lynchburg, Va	20	17	10	32	n. 82 w.	22
Norfolk, Va	25	20	13	19	n. 50 w.	8
Richmond, Va	23	20	11	20	n. 72 w.	10
Wytheville, Va	14	9	11	39	n. 80 w.	28
South Atlantic States.						
Asheville, N. C	29	20	14	13	n. 6 e.	9
Charlotte, N. C	22	18	22	16	n. 56 e.	7
Hatteras, N. C	33	13	11	19	n. 22 w.	22
Kitty Hawk, N. C.†	13	8	10	9	n. 11 e.	5
Raleigh, N. C	26	17	13	20	n. 38 w.	11
Wilmington, N. C	25	12	15	21	n. 25 w.	14
Charleston, S. C	29	11	15	22	n. 21 w.	19
Columbia, S. C	22	15	20	21	n. 8 w.	7
Augusta, Ga	24	12	15	25	n. 40 w.	16
Savannah, Ga	34	9	16	17	n. 2 w.	25
Jacksonville, Fla	30	15	10	23	n. 41 w.	20
Florida Peninsula.						
Jupiter, Fla	20	11	18	22	n. 24 w.	10
Key West, Fla	33	7	33	4	n. 48 e.	39
Tampa, Fla	31	10	18	21	n. 9 w.	20
Eastern Gulf States.						
Atlanta, Ga	27	16	13	28	n. 54 w.	19
Macon, Ga.†	15	6	4	11	n. 38 w.	11
Pensacola, Fla.†	16	4	10	7	n. 14 e.	12
Mobile, Ala	34	16	8	14	n. 12 w.	29
Montgomery, Ala	25	11	22	16	n. 23 e.	15
Meridian, Miss†	10	9	14	6	n. 83 e.	8
Vicksburg, Miss	20	22	24	13	s. 80 e.	11
New Orleans, La	28	15	22	9	n. 45 e.	18
Western Gulf States.						
Shreveport, La	21	20	22	16	n. 80 e.	6
Fort Smith, Ark	12	9	27	23	n. 53 e.	5
Little Rock, Ark	19	18	15	24	n. 84 w.	9
Corpus Christi, Tex	29	19	21	5	n. 58 e.	19
Galveston, Tex	20	16	29	11	n. 77 e.	18
Palestine, Tex	23	20	18	14	n. 53 e.	5
San Antonio, Tex	25	18	20	13	n. 45 e.	10
Taylor, Tex †	16	9	4	7	n. 23 w.	8
Ohio Valley and Tennessee.						
Chattanooga, Tenn	25	14	15	24	n. 39 w.	14
Knoxville, Tenn	24	14	2	37	n. 74 w.	36
Memphis, Tenn	20	21	16	18	s. 63 w.	2
Nashville, Tenn	20	22	15	19	s. 63 w.	4
Lexington, Ky. †	6	14	9	12	s. 21 w.	8
Louisville, Ky	14	24	13	25	s. 50 w.	16
Evansville, Ind.†	11	12	7	11	s. 76 w.	4
Indianapolis, Ind	14	27	10	24	s. 47 w.	19
Cincinnati, Ohio	12	22	17	28	s. 48 w.	15
Columbus, Ohio	10	26	15	25	s. 32 w.	19
Pittsburg, Pa	24	17	14	29	n. 65 w.	17
Parkersburg, W. Va	16	20	12	28	s. 76 w.	16
Elkins, W. Va	14	20	6	30	s. 76 w.	25
Lower Lake Region.						
Buffalo, N. Y	12	14	16	30	s. 82 w.	14
Oswego, N. Y	21	26	17	15	s. 22 e.	5
Rochester, N. Y	11	20	13	32	s. 65 w.	21
Syracuse, N. Y	13	24	12	26	s. 52 w.	18
Erie, Pa	18	19	10	27	s. 87 w.	17
Cleveland, Ohio	11	29	17	19	s. 6 w.	18
Sandusky, Ohio†	7	10	7	15	s. 69 w.	8
Toledo, Ohio	14	25	11	29	s. 59 w.	21
Detroit, Mich	16	16	11	30	w.	19
Upper Lake Region.						
Alpena, Mich	22	14	13	27	n. 60 w.	16
Escanaba, Mich	26	14	8	30	n. 61 w.	25
Grand Haven, Mich	21	14	18	21	n. 23 w.	8
Houghton, Mich.†	10	6	15	9	n. 56 e.	7
Marquette, Mich	20	15	11	30	n. 75 w.	20
Port Huron, Mich	14	21	15	28	s. 62 w.	15
Sault Ste. Marie, Mich	19	15	25	16	n. 66 e.	10
Chicago, Ill	15	20	14	27	s. 69 w.	14
Milwaukee, Wis	15	13	14	33	n. 84 w.	19
Green Bay, Wis	22	21	9	25	n. 87 w.	16
Duluth, Minn	24	16	10	29	n. 67 w.	21
North Dakota.						
Moorhead, Minn	25	18	18	23	n. 36 w.	9
Bismarck, N. Dak	30	12	15	21	n. 18 w.	19
Williston, N. Dak	20	20	10	19	w.	9

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
Upper Mississippi Valley.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
St. Paul, Minn	19	16	17	24	n. 67 w.	8
La Crosse, Wis. †	12	13	4	7	s. 72 w.	3
Davenport, Iowa	16	16	15	25	w.	10
Des Moines, Iowa	22	18	18	22	n. 45 w.	6
Dubuque, Iowa	21	19	16	23	n. 74 w.	7
Keokuk, Iowa	23	22	12	21	n. 84 w.	9
Cairo, Ill	21	23	16	18	s. 45 w.	3
Springfield, Ill	19	18	14	27	n. 86 w.	13
Hannibal, Mo. †	11	9	7	10	n. 56 w.	4
St. Louis, Mo	19	25	10	21	s. 61 w.	12
Missouri Valley.						
Columbia, Mo. *	11	11	8	9	w.	1
Kansas City, Mo	23	24	13	19	s. 80 w.	6
Springfield, Mo	18	22	14	23	s. 66 w.	10
Topeka, Kans	9	8	7	7	n.	1
Lincoln, Nebr	26	22	10	22	n. 72 w.	13
Omaha, Nebr	24	23	10	16	n. 80 w.	6
Valentine, Nebr	21	13	13	29	n. 63 w.	18
Sioux City, Iowa †	13	9	6	11	n. 51 w.	6
Pierre, S. Dak	22	11	26	13	n. 50 e.	17
Huron, S. Dak	27	20	20	13	n. 45 e.	10
Yankton, S. Dak. †	13	6	8	14	n. 41 w.	9
Northern Slope.						
Havre, Mont	21	14	19	28	n. 52 w.	11
Miles City, Mont	21	27	10	19	s. 56 w.	11
Helena, Mont	18	25	11	25	s. 63 w.	16
Kalispell, Mont	9	9	4	47	w.	43
Rapid City, S. Dak	25	8	11	33	n. 52 w.	28
Cheyenne, Wyo	19	14	4	38	n. 82 w.	34
Lander, Wyo	20	24	17	15	s. 27 e.	4
North Platte, Nebr	15	15	15	29	w.	14
Middle Slope.						
Denver, Colo	21	29	10	12	s. 14 w.	8
Pueblo, Colo	25	13	19	22	n. 14 w.	12
Concordia, Kans	22	18	10	18	n. 63 w.	9
Dodge, Kans	27	13	13	21	n. 30 w.	16
Wichita, Kans	28	21	15	13	n. 16 e.	7
Oklahoma, Okla	25	24	13	10	n. 72 w.	3
Southern Slope.						
Abilene, Texas	22	23	11	17	s. 80 w.	6
Amarillo, Tex	16	24	13	25	s. 56 w.	14
Southern Plateau.						
El Paso, Texas	29	1	14	31	n. 59 w.	33
Santa Fe, N. Mex	34	13	22	7	n. 35 e.	26
Flagstaff, Ariz	23	12	21	21	n.	11
Phoenix, Ariz	13	12	24	24	n.	1
Yuma, Ariz	44	5	15	7	n. 11 e.	40
Independence, Cal	22	18	10	29	n. 78 w.	19
Middle Plateau.						
Carson City, Nev	13	30	12	20	s. 25 w.	19
Winnemucca, Nev	19	14	21	23	n. 22 w.	5
Modena, Utah	14	14	14	33	w.	19
Salt Lake City, Utah	20	19	22	14	n. 83 e.	8
Grand Junction, Colo	20	15	23	21	n. 22 e.	5
Northern Plateau.						
Baker City, Oreg	5	38	24	15	s. 15 e.	34
Boise, Idaho	12	22	21	21	s.	10
Lewiston, Idaho †	3	6	15	7	s. 69 e.	8
Pocatello, Idaho	1	25	34	13	s. 41 e.	32
Spokane, Wash	14	25	24	9	s. 54 e.	19
Walla Walla, Wash	8	35	3	25	s. 39 w.	35
North Pacific Coast Region.						
North Head, Wash	7	25	33	13	s. 48 e.	27
Port Crescent, Wash. *	0	17	13	11	s. 7 e.	17
Seattle, Wash	10	31	33	4	s. 54 e.	36
Tacoma, Wash	13	37	8	17	s. 21 w.	26
Tatoosh Island, Wash	7	24	22	18	s. 13 e.	18
Astoria, Oreg	12	18	33	11	s. 75 e.	23
Portland, Oreg	12	24	23	16	s. 30 e.	14
Roseburg, Oreg	9	29	17	20	s. 9 w.	20
Middle Pacific Coast Region.						
Eureka, Cal	14	34	15	12	s. 9 e.	20
Mount Tamalpais, Cal	20	20	15	24	w.	9
Red Bluff, Cal	30	20	15	11	n. 22 e.	11
Sacramento, Cal	17	24	28	10	s. 69 e.	19
San Francisco, Cal	26	13	11	24	n. 45 w.	18
South Pacific Coast Region.						
Fresno, Cal	18	8	29	18	n. 48 e.	15
Los Angeles, Cal	23	7	23	23	n.	16
San Diego, Cal	31	7	18	18	n.	24
San Luis Obispo, Cal	33	13	1	18	n. 40 w.	26
West Indies.						
Basseterre St. Kitts, W. I	21	7	46	0	n. 73 e.	48
Bridgetown, Barbados	8	6	56	0	n. 88 e.	56
Cienfuegos, Cuba						
Colon, Columbia, S. A. †						
Grand Turk, Turks Island †	6	4	24	3	n. 85 e.	21
Hamilton, Bermuda	21	23	13	24	s. 80 w.	11
Havana, Cuba	24	4	35	5	n. 56 e.	36
Kingston, Jamaica						
Port of Spain, Trinidad, W. I †						
Puerto Principe, Cuba	42	0	38	2	n. 40 e.	55
Roseau, Dominica, W. I †						
San Juan, Porto Rico	2	35	35	4	s. 43 e.	45
Santiago de Cuba, Cuba	49	5	9	8	n. 1 e.	44
Santo Domingo, S. Dom., W. I ‡	39	3	3	0	n. 5 e.	36
Willemstad						

* From observations at 8 p. m. only. † From observations at 8 a. m. only. ‡ Record for 22 days only.

TABLE IV.—*Thunderstorms and auroras, December, 1902.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	52	T.	...	2	....	1	....	....	....	....	....	....	....	....	....	....	8	2	....	....	....	1	....	....	....	....	....	....	1	1	1	2	....	19	9	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arizona	56	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	2	....	....	....	....	....	....	....	....	....	....	....	....	6	2	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arkansas	57	T.	....	2	....	....	....	....	....	....	....	....	1	7	1	13	5	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	31	7	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
California	167	T.	1	....	....	....	....	....	....	....	....	6	3	....	1	....	....	3	....	1	....	3	....	....	....	....	....	....	....	....	1	....	....	19	8	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Colorado	81	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Connecticut	21	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	1	T.
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Delaware	5	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Dist. of Columbia	4	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Florida	47	T.	....	5	5	9	1	....	....	....	....	....	....	5	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	26	6	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Georgia	55	T.	....	5	1	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	10	4	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Idaho	34	T.	1	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	2	T.
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Illinois	92	T.	1	....	....	....	....	....	....	....	....	....	....	11	....	....	....	....	....	....	....	11	1	....	....	....	....	....	....	....	....	....	....	24	4	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Indiana	58	T.	....	....	....	....	....	....	....	....	....	....	1	3	7	....	....	....	....	....	....	....	10	....	....	....	....	....	....	....	....	....	....	21	4	T.
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Indian Territory	11	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	1	T.
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Iowa	149	T.	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	4	2	T.
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Kansas	77	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1	1	T.
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Kentucky	41	T.	....	....	....	....	....	....	....	....	....	....	2	6	11	....	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	26	4	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Louisiana	46	T.	6	6	5	3	....	1	....	....	....	....	1	....	1	5	14	....	1	....	....	1	....	....	....	....	....	....	1	....	....	....	....	45	12	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Maine	19	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Maryland	48	T.	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Massachusetts	48	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	6	2	T.
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Michigan	106	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Minnesota	67	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Mississippi	44	T.	....	4	....	1	....	....	....	....	....	....	....	....	....	....	16	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	22	4	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Missouri	95	T.	....	....	....	....	....	....	....	....	....	....	....	20	2	1	....	....	....	....	1	15	....	....	....	....	....	....	....	....	....	....	....	39	5	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Montana	40	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Nebraska	142	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	....	....	....	....	2	2	T.
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Nevada	40	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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New Hampshire	19	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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New Jersey	51	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New Mexico	31	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	T.
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New York	99	T.	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	4	2	T.
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North Carolina	56	T.	....	3	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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North Dakota	48	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Ohio	128	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	....	....	....	2	....	....	....	....	....	....	....	7	2	T.
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Oklahoma	23	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	2	T.
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Oregon	74	T.	....	....	....	....	....	....	....	....	....	4	4	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	10	3	T.
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Pennsylvania	91	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Rhode Island	7	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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South Carolina	46	T.	2	4	2	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	13	4	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Dakota	56	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
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Tennessee	56	T.	....	....	....	....	....	....	....	....	....	....	....	2	....	2	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7	3	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1	....	....	....	3	3	A.
Texas	95	T.	1	5	....	....	....	....	....	....	....	....	1	....	2	1	6	....	....	....	....	....	1	....	1	1	1	1	....	....	....	....	....	21	11	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Utah	47	T.	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Vermont	16	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Virginia	50	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	4	2	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Washington	64	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	1	....	....	....	....	....	....	3	3	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
West Virginia	43	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Wisconsin	60	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Wyoming	31	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Sums	2,893	T.	14	36	17	22	2	1	0	0	0	6	16	58	25	26	61	8	2	6	4	37	21	3	1	3	1	4	4	2	4	2	0	386	118	T.
		A.	0	1	1	0	3	0	0	0	0	0	0	1	1	1	0	3	0	0	4	0	0	0	0	2	2	0	0	1	0	0	0	20	15	A.

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during December, 1902, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	21-22			1.02														*			
Alpena, Mich.	2-3			0.71														*			
Asheville, N. C.	4			0.63														0.19			
Atlanta, Ga.	15-16			2.32														0.67			
Atlantic City, N. J.	21-22	6:00 p. m.	D. N.	1.93	9:22 p. m.	10:35 p. m.	0.21	0.07	0.17	0.25	0.31	0.38	0.49	0.58	0.69	0.82	0.97	1.10	1.42		
Augusta, Ga.	12			0.70														0.40			
Baltimore, Md.	2-3			0.96														0.25			
Binghamton, N. Y.	15-16			0.63														*			
Bismarck, N. Dak.	10			0.08														*			
Block Island, R. I.	25-26			1.44														*			
Boise, Idaho.	7			0.25														0.08			
Boston, Mass.	21-22			1.24														0.26			
Buffalo, N. Y.	2-3			0.46														0.13			
Cairo, Ill.	12	1:15 p. m.	10:30 p. m.	1.07	9:00 p. m.	9:30 p. m.	0.36	0.08	0.35	0.47	0.52	0.59	0.64	0.66							
Charleston, S. C.	4	12:25 a. m.	11:26 a. m.	2.87	8:55 a. m.	10:10 a. m.	1.24	0.05	0.12	0.24	0.31	0.39	0.42	0.56	0.63	0.72	0.82	0.94	1.46		
Charlotte, N. C.	21			0.75														0.32			
Chattanooga, Tenn.	2			0.81														0.30			
Chicago, Ill.	19-20			0.49														*			
Cincinnati, Ohio.	2			0.98														0.42			
Cleveland, Ohio.	15-16			0.62														*			
Columbia, Mo.	2			0.55														0.28			
Columbia, S. C.	12	10:07 a. m.	4:20 p. m.	1.51	3:10 p. m.	3:40 p. m.	0.79	0.06	0.15	0.30	0.47	0.58	0.67	0.69	0.71						
Columbus, Ohio.	2			0.42														0.22			
Corpus Christi, Tex.	7			0.40														0.32			
Davenport, Iowa.	2-3			0.59														*			
Denver, Colo.	13-14			0.36														*			
Des Moines, Iowa.	2-3			0.55														*			
Detroit, Mich.	2-3			0.54														0.19			
Dodge, Kans.	13-14			0.28														*			
Dubuque, Iowa.	19-20			0.59														0.11			
Duluth, Minn.	15-16			0.80														*			
Eastport, Me.	16-17			1.77														0.29			
Elkins, W. Va.	15-16			1.32														0.25			
Erie, Pa.	13-14			0.74														*			
Escanaba, Mich.	20-21			0.36														0.08			
Evansville, Ind.	12-13	8:33 p. m.	12:40 a. m.	0.78	10:00 p. m.	10:30 p. m.	0.65	0.03	0.19	0.32	0.43	0.47	0.51								
Fort Smith, Ark.	2			0.77														0.22			
Fort Worth, Tex.	1-2			0.68														0.19			
Galveston, Tex.	15	1:10 a. m.	7:35 a. m.	0.73	5:50 a. m.	6:20 a. m.	0.17	0.18	0.32	0.40	0.42	0.45	0.50	0.53							
Grand Haven, Mich.	2-3			0.86														0.09			
Grand Junction, Colo.	13-14			0.34														*			
Green Bay, Wis.	2-3			0.40														*			
Harrisburg, Pa.	21			0.67														0.23			
Hatteras, N. C.	4-5			1.57														*			
Huron, S. Dak.	19-20			1.01														*			
Indianapolis, Ind.	20-21			0.63														0.32			
Jacksonville, Fla.	3-4	‡ 12:35 a. m.	‡ 3:30 p. m.	5.72	§‡ 4:30 a. m.	‡ 4:52 a. m.	3.69	0.09	0.19	0.39	0.54	0.71	0.72								
					∕‡ 8:45 a. m.	‡ 9:20 a. m.	4.54	0.17	0.38	0.43	0.48	0.54	0.80	0.93	0.94						
Jupiter, Fla.	12			0.55														0.36			
Kalispell, Mont.	24			0.66														*			
Kansas City, Mo.	14-15			1.02														*			
Key West, Fla.	11-12	11:00 p. m.	5:00 a. m.	1.12	3:55 a. m.	4:30 a. m.	0.32	0.07	0.28	0.43	0.45	0.51	0.71	0.80							
Knoxville, Tenn.	20-21			1.02														0.27			
La Crosse, Wis.	2-3			0.67														*			
Lewiston, Idaho.	26-27			0.37														0.09			
Lexington, Ky.	14-16			1.93														*			
Lincoln, Nebr.	20			0.60														*			
Little Rock, Ark.	2			1.31														0.66			
Los Angeles, Cal.	16-17			1.36														0.26			
Louisville, Ky.	11-13			1.74														0.44			
Lynchburg, Va.	15-16			0.97														0.24			
Macon, Ga.	4			0.77														0.43			
Memphis, Tenn.	14-15	‖ 6:15 a. m.	‖ 4:45 p. m.	4.55	‖ 2:30 a. m.	‖ 3:55 a. m.	1.91	0.08	0.16	0.28	0.41	0.50	0.57	0.64	0.68	0.70	0.79	0.89	1.18		
Meridian, Miss.	15			1.41														0.67			
Milwaukee, Wis.	2-3			0.94														0.09			
Montgomery, Ala.	15-16	4:55 p. m.	9:30 a. m.	3.55	§ 6:00 p. m.	7:00 p. m.	0.10	0.05	0.13	0.19	0.25	0.29	0.29	0.30	0.35	0.72	0.86	1.03	1.10		
					‖ 2:05 a. m.	2:35 a. m.	2.90	0.10	0.18	0.29	0.35	0.45	0.60	0.62							
Nantucket, Mass.	16-17			1.07														0.21			
Nashville, Tenn.	14-15			3.20														0.46			
New Haven, Conn.	21-22			2.12														0.44			
New Orleans, La.	15	3:38 p. m.	5:55 p. m.	1.32	4:25 p. m.	5:45 p. m.	0.06	0.08	0.12	0.13	0.17	0.26	0.33	0.46	0.55	0.58	0.65	0.97	1.23		
New York, N. Y.	15-16			1.84														0.32			
Norfolk, Va.	16-17			0.68														0.44			
Northfield, Vt.	21-22			1.19														*			
Oklahoma, Okla.	13-15			1.50														*			
Omaha, Nebr.	19			0.61														0.15			
Palestine, Tex.	1-2			0.80														0.46			
Parkersburg, W. Va.	15-16			1.19														0.27			
Pensacola, Fla.	2			0.81														0.55			
Philadelphia, Pa.	21-22			2.03														0.56			
Pittsburg, Pa.	12-13			0.72														*			
Pocatello, Idaho.	3-4			0.28														*			
Portland, Me.	21-22			1.72														0.37			
Portland, Oreg.	25			0.55														0.23			
Pueblo, Colo.	13-14			0.45														*			
Raleigh, N. C.	12-13			0.89														0.28			
Richmond, Va.	21			1.33														0.26			
Rochester, N. Y.	13-14			1.06														*			
St. Louis, Mo.	12-13			1.37														0.54			
St. Paul, Minn.	20			0.68														0.16			
Salt Lake City, Utah.	11-12			0.72														*			
San Antonio, Cal.	1-2			1.41														0.61			
San Diego, Cal.	16-17			1.70														0.65			
Sandusky, Ohio.	12-13			0.74														*			
San Francisco, Cal.	9-10			0.74														0.36			
Savannah, Ga.	3-4	4:13 p. m.	10:23 a. m.	2.44	7:45 a. m.	8:34 a. m.	1.04	0.05	0.16	0.25	0.38	0.48	0.61	0.67	0.78	1.10					
Scranton, Pa.	15-16			1.46														0.18			
Seattle, Wash.	24-25			1.61														0.22			
Shreveport, La.	14-15	8:30 p. m.	4:30 a. m.	1.32	1:35 a. m.	1:55 a. m.	0.30	0.09	0.39	0.48	0.59	0.62	0.64	0.66							
Spokane, Wash.	31			0.40														*			
Springfield, Ill.	2			0.51														0.19			
Springfield, Mo.	13-14			1.02														*			
Tampa, Fla.	4			0.84														0.37			

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Taylor, Tex.	1–2			1.06														0.41			
Toledo, Ohio	13			0.40														*			
Topeka, Kan	14–15			0.58														*			
Valentine, Nebr	5–6			0.44														*			
Vicksburg, Miss	15	7:25 a. m.	1:40 p. m.	1.91	7:40 a. m.	8:05 a. m.	T.	0.31	0.78	0.96	1.02	1.08	1.12	1.14							
Washington, D. C	15–16			1.23														0.42			
Wilmington, N. C	7			1.70														0.39			
Yankton, S. Dak	19–20			0.96														*			
Basseterre, St. Kitts	21	12:15 p. m.	4:10 p. m.	0.78	12:15 p. m.	12:46 p. m.	0.00	0.04	0.07	0.17	0.30	0.46	0.59	0.62							
Bridgetown, Barbados	22–23			1.93														0.40			
Havana, Cuba	9			0.22														0.16			
Puerto Principe, Cuba	9–10			1.45														0.44			
San Juan, Porto Rico	19	6:55 p. m.	8:50 p. m.	1.66	7:24 p. m.	8:05 p. m.	0.02	0.16	0.40	0.70	0.83	0.94	1.12	1.30	1.39	1.42	1.46	1.55			
Santiago de Cuba, Cuba	7			0.44														0.44			
Santo Domingo, S. Dom.	10			0.34								0.34									

*Self-register not working. †December 3, 1902. ‡December 4, 1902. §December 14, 1902. ‖December 15, 1902.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, December, 1902.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure, in inches. Sea level, reduced to mean of 24 hours.	Pressure, in inches. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F	29.61	29.75	—.08	28.0	— 0.7	34.2	21.9	5.68	+0.65	18.4
Sydney, C. B. I	29.88	29.92	+.03	28.3	+ 0.1	33.9	22.6	8.65	+4.02	16.5
Halifax, N. S	29.88	29.99	+.03	27.1	— 0.5	34.3	19.9	7.93	+2.81	24.7
Grand Manan, N. B	29.92	29.97	—.01	25.7	— 2.6	33.4	17.9	7.79	+3.37	38.6
Yarmouth, N. S	29.92	29.99	+.01	28.0	— 2.7	35.0	21.1	5.96	+0.92	24.8
Charlottetown, P. E. I	29.90	29.94	.00	23.7	— 0.6	29.7	17.7	3.90	+0.24	24.9
Chatham, N. B	29.92	29.95	+.01	16.8	— 0.2	24.9	8.7	3.82	+0.60	21.0
Father Point, Que	29.98	30.01	+.06	13.6	— 1.8	20.7	6.6	2.88	+0.05	27.8
Quebec, Que	29.70	30.04	+.03	11.7	— 3.5	18.8	4.6	3.18	—0.51	23.2
Montreal, Que	29.85	30.07	+.04	15.9	— 2.4	23.2	8.5	4.34	+0.69	32.4
Bissett, Ont	29.46	30.10	+.09	9.2	— 5.8	21.0	— 2.6	2.02	—0.47	20.0
Ottawa, Ont	29.79	30.14	+.12	14.7	— 2.3	22.6	6.8	3.26	+0.35	24.5
Kingston, Ont	29.74	30.08	+.04	21.4	— 2.3	29.2	13.6	2.77	—0.47	15.5
Toronto, Ont	29.67	30.07	+.02	26.0	— 1.0	34.4	17.6	2.22	—0.69	6.6
White River, Ont	28.74	30.13	+.16	5.4	— 4.3	17.8	— 7.0	2.36	+0.65	23.6
Port Stanley, Ont	29.41	30.07	.00	26.4	— 2.0	32.9	19.9	3.75	+1.33	17.1
Saugeen, Ont	29.32	30.05	+.03	25.8	— 0.9	33.2	18.4	1.95	+2.03	15.4
Parry Sound, Ont	29.32	30.05	+.04	18.7	— 2.5	27.5	9.9	4.60	+ 0.12	31.2
Port Arthur, Ont	29.37	30.12	+.13	11.7	— 1.5	20.8	2.5	0.46	— 0.41	4.6
Winnipeg, Man	29.25	30.14	+.12	4.5	+ 0.4	14.1	— 5.0	1.50	+ 0.59	15.0
Minnedosa, Man	28.21	30.15	+.13	3.0	— 2.7	13.2	— 7.3	0.72	+ 0.10	7.2
Qu'Appelle, Assin	27.70	30.08	+.08	3.3	— 4.1	11.7	— 5.1	0.84	+ 0.32	8.4
Medicine Hat, Assin	27.66	30.05	+.08	11.8	— 6.4	22.1	1.6	1.15	+ 0.60	11.5
Swift Current, Assin	27.38	30.09	+.10	9.9	— 6.1	18.4	1.4	0.36	— 0.42	3.6
Calgary, Alberta	26.26	29.97	+.03	12.4	— 5.8	21.0	3.8	0.60	+ 0.01	6.0
Banff, Alberta	25.21	30.01	+.07	13.7	— 5.4	21.5	5.8	1.47	+ 0.26	13.5
Edmonton, Alberta	27.58	30.00	+.07	5.8	— 7.3	14.7	— 3.0	1.05	+ 0.35	10.5
Prince Albert, Sask	28.41	30.06	+.05	0.1	— 2.7	10.7	—10.5	0.11	— 0.63	1.1
Battleford, Sask	28.26	30.13	+.14	—0.7	— 6.1	8.4	— 9.8	0.46	+ 0.14	4.6
Kamloops, B. C	28.68	29.93	—.01	25.5	— 3.4	31.4	19.6	1.62	+ 0.84	15.2
Victoria, B. C	29.84	29.94	—.03	41.0	— 0.2	44.9	37.1	6.23	— 1.75	4.8
Barkerville, B. C	25.44	29.85	—.03	18.4	— 2.5	25.5	11.2	1.50	— 1.67	15.0
Hamilton, Bermuda	29.95	30.12	.00	64.8	+ 0.1	69.3	60.2	6.96	+ 2.47	

TABLE VII.—*Heights of rivers referred to zeros of gages, December, 1902.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn.[6]	1,954	14						
Red Wing, Minn.[6]	1,914	14						
Reeds Landing, Minn.[1]	1,884	12	3.3	1	0.6	15, 16	1.4	2.7
La Crosse, Wis.[7]	1,819	12						
Prairie du Chien, Wis.[3]	1,759	18						
Dubuque, Iowa.[5]	1,699	15	6.8	1	2.8	11–13	5.0	4.0
Leclaire, Iowa.[4]	1,609	10	4.6	1	0.2	15, 16	2.0	4.4
Davenport, Iowa	1,593	15	6.0	1	1.6	12, 15	3.5	4.4
Muscatine, Iowa	1,562	16	7.6	31	2.6	13, 14, 17	4.5	5.0
Galland, Iowa	1,472	8	3.8	1–3	1.3	13, 14, 16, 19	2.6	2.5
Keokuk, Iowa	1,463	15	6.8	1	1.8	14	4.3	5.0
Hannibal, Mo	1,402	13	8.0	23, 24	2.9	16–19	5.4	5.1
Grafton, Ill	1,306	23	10.6	25	6.3	17, 18	8.7	4.3
St. Louis, Mo	1,264	30	14.7	1	8.8	17, 18	12.1	5.9
Chester, Ill	1,189	30	11.7	26, 27	8.2	18, 19	10.1	3.5
New Madrid, Mo	1,003	34	31.7	27	15.0	1	24.2	16.7
Memphis, Tenn	843	33	30.0	29, 30	8.4	1	20.5	21.6
Helena, Ark	767	42	38.8	30, 31	10.9	2	26.7	27.9
Arkansas City, Ark	635	42	40.8	31	18.0	1	29.6	22.8
Greenville, Miss	595	42	35.0	31	14.4	1	24.7	20.6
Vicksburg, Miss	474	45	37.9	31	13.3	1	25.8	24.6
New Orleans, La	108	16	13.0	30, 31	4.2	1	8.4	8.8
James River.								
Huron, S. Dak.[16]	210	9						
Missouri River.								
Bismarck, N. Dak	1,309	14	3.0	31	1.8	24	2.3	1.2
Pierre, S. Dak.[9]	1,114	14						
Sioux City, Iowa[8]	784	19						
Omaha, Nebr.[6]	669	18						
St. Joseph, Mo	481	10	1.3	30	—2.1	16	—0.2	3.4
Kansas City, Mo	388	21	12.0	31	3.5	15	6.6	8.5
Boonville, Mo	199	20	10.5	25	4.8	19	7.4	5.7
Hermann, Mo	103	24	10.8	26	6.0	31	8.4	4.8
Illinois River.								
Peoria, Ill	135	14	14.1	27–31	11.8	19	12.7	2.3
Youghiogheny River.								
Confluence, Pa	59	10	6.9	12	2.1	10	3.7	4.8
West Newton, Pa.[9]	15	23	10.9	12	1.7	2	4.6	9.2
Allegheny River.								
Warren, Pa	177	14	6.9	23	0.8	3	2.3	6.1
Oil City, Pa	123	13	7.5	23	1.3	2, 3	3.1	6.2
Parker, Pa	73	20	9.0	23	1.5	3	4.0	7.5
Freeport, Pa	29	20	14.7	23	3.5	2, 3	7.2	11.2
Monongahela River.								
Weston, W. Va.[10]	161	18	11.0	16	2.0	20	3.4	9.0
Fairmont, W. Va	119	25	18.8	13	2.0	27–29	6.3	16.8
Greensboro, Pa	81	18	21.0	13	7.7	29	11.2	13.4
Lock No. 4, Pa	40	28	27.0	13	7.9	29	13.3	19.1
Conemaugh River.								
Johnstown, Pa	64	7	7.0	12	0.9	1, 2	3.0	6.1
Red Bank Creek.								
Brookville, Pa	35	8	2.7	22	—0.1	1	1.7	2.8
Beaver River.								
Elwood Junction, Pa.[11]	10	14	7.4	17	2.5	10–12	3.7	4.9
Great Kanawha, River.								
Charleston, W. Va	58	30	11.5	14	4.0	29	6.8	7.5
Little Kanawha River.								
Glenville, W. Va	103	20	16.2	16	0.6	28	3.9	15.6
New River.								
Hinton, W. Va	93	14	4.7	18	1.4	30	2.8	3.3
Cheat River.								
Rowlesburg, W. Va.[11]	36	14	8.0	12	2.6	10, 26	4.4	5.4
Ohio River.								
Pittsburg, Pa	966	22	17.5	14	3.4	2	8.6	14.1
Davis Island Dam, Pa	960	25	16.8	14	5.4	2	9.6	11.4
Wheeling, W. Va	875	36	25.9	18	6.8	3	13.1	19.1
Parkersburg, W. Va	785	36	29.0	17	8.0	2	15.1	21.0

TABLE VII.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Ohio River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Point Pleasant, W. Va.	705	39	34.9	17	9.2	2	18.2	25.7
Huntington, W. Va.	660	50	39.8	18	13.3	2,3	22.3	26.5
Catlettsburg, Ky.	651	50	41.6	18	12.9	2,3	22.4	28.7
Portsmouth, Ohio	612	50	43.3	17	13.5	3	23.7	29.8
Cincinnati, Ohio.	499	50	47.0	18	15.2	1,2	26.9	31.8
Madison, Ind	413	46	40.8	19	13.3	2	24.0	27.5
Louisville, Ky.	367	28	24.3	19	7.7	2	12.0	16.6
Evansville, Ind.	184	35	40.0	22	9.3	1	24.9	30.7
Paducah, Ky.	47	40	35.4	24	10.2	1	24.2	25.2
Cairo, Ill.	1,073	45	39.0	26,27	18.7	1	29.7	20.3
Muskingum River.								
Zanesville, Ohio	70	20	17.2	17	6.5	2	9.8	10.7
Scioto River.								
Columbus, Ohio[10]	110	17	10.0	17	2.8	1,2,4,5	4.7	7.2
Miami River.								
Dayton, Ohio[5]	77	18	6.7	17	1.9	10,11	3.3	4.8
Wabash River.								
Mount Carmel, Ill.	50	15	17.0	25	6.0	2	11.5	11.0
Licking River.								
Falmouth, Ky.	30	25	28.2	16	2.7	2	8.1	25.5
Kentucky River.								
High Bridge, Ky.	117	17	26.7	16	10.5	2,29	13.9	16.2
Frankfort, Ky.	65	31	26.0	16	7.0	2,29	10.7	19.0
Clinch River.								
Speers Ferry, Va.	156	20	3.7	17	0.3	11,12,29	0.9	3.4
Clinton, Tenn.	52	25	11.5	18	4.8	15	7.3	6.7
Holston River.								
Rogersville, Tenn.	103	14	3.1	6	1.8	29	2.3	1.3
French Broad River.								
Leadvale, Tenn.	70	15	1.8	4	−0.8	15,30	0.0	2.6
Tennessee River.								
Knoxville, Tenn.	635	29	3.4	5	1.4	30	2.2	2.0
Kingston, Tenn.	556	25	6.1	22	2.2	14,15	3.8	3.9
Chattanooga, Tenn.	452	33	9.6	23	3.4	15	6.0	6.2
Bridgeport, Ala.	402	24	7.6	23	2.1	15	4.5	5.5
Florence, Ala.	255	16	7.7	25	2.7	15	5.6	5.0
Riverton, Ala.	225	25	10.6	25	3.5	15	7.7	7.1
Johnsonville, Tenn.	95	24	19.9	17,18	6.4	1	11.4	13.5
Cumberland River.								
Burnside, Ky.	516	50	34.4	17	4.1	31	11.5	30.3
Carthage, Tenn.	305	40	30.7	19	6.0	13	14.5	24.7
Nashville, Tenn.	189	40	33.3	21	9.4	14	20.4	23.9
Clarksville, Tenn.	126	42	42.3	17	15.1	13	26.1	27.2
Arkansas River.								
Wichita, Kans.	832	10	1.6	22	1.2	5–8	1.4	0.4
Webbers Falls, Ind. T.	465	23	13.1	17	4.4	13,14	7.0	8.7
Fort Smith, Ark.	403	22	16.3	18	5.6	31	8.8	10.7
Dardanelle, Ark.	256	21	16.3	18	6.5	31	10.2	9.8
Little Rock, Ark.	176	23	19.2	19	9.4	31	13.4	9.8
White River.								
Newport, Ark.	150	26	24.4	19,20	10.3	13	15.8	14.1
Yazoo River.								
Yazoo City, Miss.	80	25	16.2	31	4.9	1	10.0	11.3
Red River.								
Arthur City, Tex.	638	27	16.5	16	7.0	31	10.9	9.5
Fulton, Ark.	515	28	32.2	1	16.0	31	25.5	16.2
Shreveport, La.	327	29	34.1	15,16	21.6	1	30.7	12.5
Alexandria, La.	118	33	32.4	25–29	18.8	1	28.5	13.6
Ouachita River.								
Camden, Ark.	304	39	36.2	1	18.6	31	30.3	17.6
Monroe, La.	122	40	31.4	31	16.8	1	24.9	14.6
Atchafalaya River.								
Melville, La.	100	31	31.4	31	16.3	1	24.8	15.1
Penobscot River.								
Mattawamkeag, Me.[2]	87							
Montague, Me.[3]	60							
Kennebec River.								
Solon, Me	86		1.0	1,7	0.0	6,9,10	0.5	1.0
Winslow, Me	46		6.0	21	3.0	6	4.7	3.0
Merrimac River.								
Franklin Junction, N. H.	110							
Concord, N. H.[2]	94							
Manchester, N. H	68		4.9	24,25	2.8	30,31	3.7	2.1
Connecticut River.								
Wells River, Vt.[2]	255							
White River Junction, Vt.[13]	209							
Bellows Falls, Vt.	170	12	5.0	23	1.9	7,8	3.1	3.1
Holyoke, Mass.	84	9	5.2	23,24	0.3	11	3.0	4.9
Hartford, Conn.	50	13	14.7	24	3.6	8	7.6	11.1

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Housatonic River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Gaylordsville, Conn	50	15	8.6	23	3.4	9	5.5	5.2
Susquehanna River.								
Binghamton, N. Y.	306	16	11.7	23	3.4	14	5.3	8.3
Towanda, Pa.	262	16	11.5	23	1.7	11	3.9	9.8
Wilkesbarre, Pa	183	17	18.2	23	5.0	2,3	9.0	13.2
Harrisburg, Pa	69	17	12.7	24	2.4	1,2	5.5	10.3
West Branch Susquehanna.								
Lock Haven, Pa.[4]	65	12	4.0	23	−0.8	3	1.6	4.8
Williamsport, Pa	39	20	10.7	23	1.0	1	4.2	9.7
Juniata River.								
Huntingdon, Pa.[11]	90	24	7.9	22	3.0	1	4.7	4.9
Shenandoah River.								
Riverton, Va	58	22	1.9	5	−0.9	31	1.2	2.8
Potomac River.								
Cumberland, Md.	290	8	7.5	17	2.6	2	4.3	4.9
Harpers Ferry, W. Va.	172	18	10.8	18	2.5	30,31	5.4	8.3
James River.								
Lynchburg, Va	260	18	4.6	18	1.2	31	2.6	3.4
Richmond, Va.	111	12	6.1	4	0.4	12,29–31	1.8	5.7
Roanoke River.								
Clarksville, Va	196	12	11.5	4	2.9	29	4.6	8.6
Weldon, N. C.	129	30	27.5	5	10.0	30	14.8	17.5
Cape Fear River.								
Fayetteville, N. C	112	38	21.6	4	5.3	30	10.9	16.3
Edisto River.								
Edisto, S. C	75	6						
Pedee River.								
Cheraw, S. C.	149	27	25.1	4	3.4	30	10.2	21.7
Black River.								
Kingstree, S. C	52	12	8.3	11	2.0	1	6.6	6.3
Lynch Creek.								
Effingham, S. C.	35	12	6.9	10	3.6	31	5.0	3.3
Santee River.								
St. Stephens, S. C.	97	12	10.1	13	7.5	1	8.5	2.6
Congaree River.								
Columbia, S. C.	37	15	11.2	4	0.8	28	3.2	10.4
Wateree River.								
Camden, S. C.	45	24	23.4	4	6.2	31	12.4	17.2
Waccamaw River.								
Conway, S. C.	40	7	5.7	17,18	3.3	1	5.0	2.4
Savannah River.								
Calhoun Falls, S. C.	347	15	6.9	3	3.0	2	3.9	3.9
Augusta, Ga.	268	32	21.3	4	8.8	12,29	11.3	12.5
Broad River.								
Carlton, Ga.	30	11	6.6	3	2.6	12,28,29	3.4	4.0
Flint River.								
Albany, Ga.	80	20	10.4	11	2.2	1	6.5	8.2
Chattahoochee River.								
Westpoint, Ga	239	20	10.1	17	2.9	15	4.6	7.2
Ocmulgee River.								
Macon, Ga.	125	18	13.3	3	3.6	17	5.8	9.7
Oconee River.								
Dublin, Ga	79	30	9.8	8	1.0	31	4.4	8.8
Coosa River.								
Rome, Ga.	271	30	6.8	4	1.1	15	3.4	5.7
Gadsden, Ga.	144	18	9.9	23	1.6	2,11,14,15	4.7	8.3
Alabama River.								
Montgomery, Ala.	265	35	21.2	19	2.7	15	9.1	18.5
Selma, Ala.[16]	212	35	25.6	20	3.8	15	12.0	21.8
Tombigbee River.								
Columbus, Miss.[15]	303	33	14.8	22	0.6	14,15	6.7	14.2
Demopolis, Ala.[16]	155	35	30.1	20	6.8	15	.....	23.3
Black Warrior River.								
Tuscaloosa, Ala.	90	43	29.6	17	7.4	15	14.4	22.2
Brazos River.								
Kopperl, Tex	369	21	2.0	3	−0.4	29–31	0.6	2.4
Waco, Tex.	301	24	8.2	2	3.4	29–31	4.4	4.8
Booth, Tex	76	39	18.0	1,5	2.5	29–31	9.0	15.5
Red River of the North.								
Moorhead, Minn.[6]	418	26						
Columbia River.								
Umatilla, Oreg.	270	25	3.0	12–16	2.1	27	2.6	0.9
The Dalles, Oreg.	166	40	3.9	13	1.2	23,24	2.7	2.7
Willamette River.								
Albany, Oreg	118	20	24.5	6	5.6	20	11.1	18.9
Portland, Oreg.	12	15	12.9	11	4.0	23	8.8	8.9
Sacramento River.								
Red Bluff, Cal.	265	23	12.4	26	2.5	1	5.9	9.9
Sacramento, Cal.	64	29	18.1	12	12.6	4–6	15.9	5.5

[1] Frozen 9 days. [2] 26 days. [3] 23 days. [4] 11 days. [5] 7 days. [6] 28 days. [7] 21 days. [8] 27 days. [9] 1 day. [10] 3 days.
[11] 5 days. [12] 25 days. [13] 20 days. [14] entire month. [15] 28 days only. [16] 30 days only.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physico-Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San José de Costa Rica, during December, 1902.*

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1902.	Normal, 1889–1900.	Observed, 1902.	Normal, 1889–1900.	Observed, 1902.	Normal, 1889–1900.	Observed, 1902.	Normal, 1889–1900.	Duration, 1902.
	660+ *Mm.*	660+ *Mm.*	° *C.*	° *C.*	%	%	*Mm.*	*Mm.*	*Hrs.*
1 a. m	4.46	3.86	16.69	16.56	86	87	0.0	0.5	0.00
2 a. m	3.78	3.44	16.42	16.40	85	87	0.0	1.9	0.00
3 a. m	3.32	3.08	16.35	16.31	84	87	0.0	0.4	0.00
4 a. m	3.19	2.95	16.31	16.16	84	87	0.0	0.5	0.00
5 a. m	3.31	3.12	16.04	16.04	84	87	0.0	1.5	0.00
6 a. m	3.50	3.42	16.06	15.94	84	87	0.0	1.3	0.00
7 a. m	3.79	3.86	16.13	16.26	85	86	0.0	1.1	0.00
8 a. m	4.12	4.25	17.74	17.75	71	81	0.0	0.9	0.00
9 a. m	4.52	4.57	20.11	19.25	65	76	1.0	0.6	0.83
10 a. m	4.57	4.70	21.53	21.12	66	71	0.0	0.5	0.00
11 a. m	4.53	4.52	22.35	22.17	59	68	0.0	1.8	0.00
Noon	4.46	4.15	23.42	22.85	56	67	0.0	1.1	0.00
1 p. m	3.58	3.45	23.70	23.19	59	67	0.3	2.1	0.33
2 p. m	2.93	3.02	23.65	23.15	57	67	0.0	2.7	0.00
3 p. m	2.55	2.56	23.17	22.68	59	69	0.0	2.4	0.00
4 p. m	2.35	2.42	22.26	21.82	66	70	1.1	5.5	1.00
5 p. m	2.43	2.62	20.90	20.57	70	76	0.0	2.3	0.00
6 p. m	2.84	2.87	19.64	19.23	75	78	0.0	2.0	0.00
7 p. m	3.21	3.39	18.73	18.34	80	83	0.0	2.3	0.00
8 p. m	3.65	3.83	18.28	17.90	80	83	0.0	1.1	0.00
9 p. m	4.11	4.11	17.75	17.59	83	85	0.0	1.3	0.00
10 p. m	4.46	4.51	17.51	17.29	83	85	0.0	1.2	0.00
11 p. m	4.48	4.45	17.22	16.95	84	86	0.0	1.8	0.00
Midnight	4.28	4.21	16.54	16.77	84	86	0.0	0.8	0.00
Mean	663.66	663.64	19.09	18.84	75	79	.....	.....	.....
Minimum	660.80	659.23	12.0	9.2	36	.....	.....	.....	.....
Maximum	666.00	667.82	28.8	29.2	100	.....	1.0	.....	.....
Total	.....	.....	.....	.....	.....	.....	2.4	37.6	2.16

REMARKS.—At San José the barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 1.5 meters above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. Since January 1, 1902, observations at San Jose have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San Jose local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San José local time; the barometer is 3.4 meters above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				
	Observed, 1902.	Normal, 1889–1900.	Observed, 1902.	Normal, 1889–1900.	0.15 m.	0.30 m.	0.60 m.	1.20 m.	3.00 m.
	Hours.	*Hours.*	%	%	° *C.*	° *C.*	° *C.*	° *C.*	° *C.*
7 a. m	5.31	4.89	53	47	21.03	21.43	21.94	21.74	21.64
8 a. m	18.46	17.86	.....	.....	.....	.....	.....	.....	.....
9 a. m	21.02	18.54	.....	.....	.....	.....	.....	.....	.....
10 a. m	17.27	17.43	66	55	21.26	21.46	22.05	21.75	.....
11 a. m	16.36	15.40	.....	.....	.....	.....	.....	.....	.....
Noon	14.31	13.98	.....	.....	.....	.....	.....	.....	.....
1 p. m	13.51	14.17	71	60	21.86	21.70	22.04	21.78	.....
2 p. m	18.22	14.95	.....	.....	.....	.....	.....	.....	.....
3 p. m	14.99	14.82	.....	.....	.....	.....	.....	.....	.....
4 p. m	14.62	14.08	70	63	22.12	21.82	22.04	21.74	.....
5 p. m	10.40	9.85	.....	.....	.....	.....	.....	.....	.....
6 p. m	1.73	1.77	.....	.....	.....	.....	.....	.....	.....
7 p. m	.....	.....	67	55	22.06	21.83	21.99	21.73	.....
8 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 p. m	.....	.....	42	48	21.78	21.77	22.00	21.72	.....
11 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
Midnight	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mean	.....	.....	63	55	21.68	21.66	22.01	21.75	21.64
Total	166.00	157.74	.....	.....	.....	.....	.....	.....	.....

TABLE 3.—*Rainfall at stations in Costa Rica, December, 1902.*

Stations.	Height above sea level.	Observed, 1902.		Averages.		
		Amount.	Number of days.	Number of years.	Amount.	Number of days.
	Meters.	*Mm.*			*Mm.*	
Sipurio (Talamanca)	60	.....		2	249	15
Boca Banano	3	287	18	6	353	21
Port Limon	3	417	11	17	424	18
Swamp Mouth	3	500	20	4	321	16
Zent	20	392	21	1	391	14
Siquirres	60	490	15	3	248	8
Dos Novillos	122	277	20	.....	.....	.....
Guapiles	300	327	19	2	394	17
Cariblanco (Sarapiqui)	835	735	24	4	408	20
San Carlos	161	220	19	4	243	18
Las Lomas	266	331	13	2	428	17
Peralta	332	128	20	4	262	17
Turrialba	620	147	21	7	452	18
Juan Viñas	1,040	132	14	6	285	11
Santiago	1,100	.....	.....	1	174	14
Paraiso	1,336	127	11	1	43	9
Cachi	1,020	68	18	1	.....	.....
Las Concavas	1,337	54	19	1	38	13
Tres Rios	1,300	.....	.....	12	49	6
San Isidro Arenilla	.....	.....	.....	.....	.....	.....
San Francisco Guadalupe	1,187	8	5	6	24	.....
San Jose	1,160	2	4	13	38	7
La Verbena	1,140	33	8	6	62	5
Nuestro Amo	791	0	0	6	16	5
Alajuela	950	67	3	2	8	3
San Isidro Alajuela	1,346	30	3	1	52	5

TABLE 4.—*Observations taken at Port Limon and Zent, December, 1902.*

Stations.	Pressure.			Temperature.			Relative humidity.
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	
	Mm.	*Mm.*	*Mm.*	° *C.*	° *C.*	° *C.*	%
Port Limon	752.69	760.13	755.55	19.0	31.0	25.36	82
Zent	.....	.....	.....	17.8	35.0	24.84	89

Stations.	Cloudiness.	Sunshine.	Rainfall.		Temperature of soil at depth of—		
			Amount.	Number of days.	0.15 *m.*	0.30 *m.*	0.60 *m.*
	%	*Hours.*	*Mm.*		° *C.*	° *C.*	° *C.*
Port Limon	80	.....	417.0	11	.....	.....	.....
Zent	79	129.10	392.0	21	26.06	26.21	26.25

MEXICAN CLIMATOLOGICAL DATA.

By Señor MANUEL E. PASTRANA, Director of the Central Meteorologic-Magnetic Observatory.

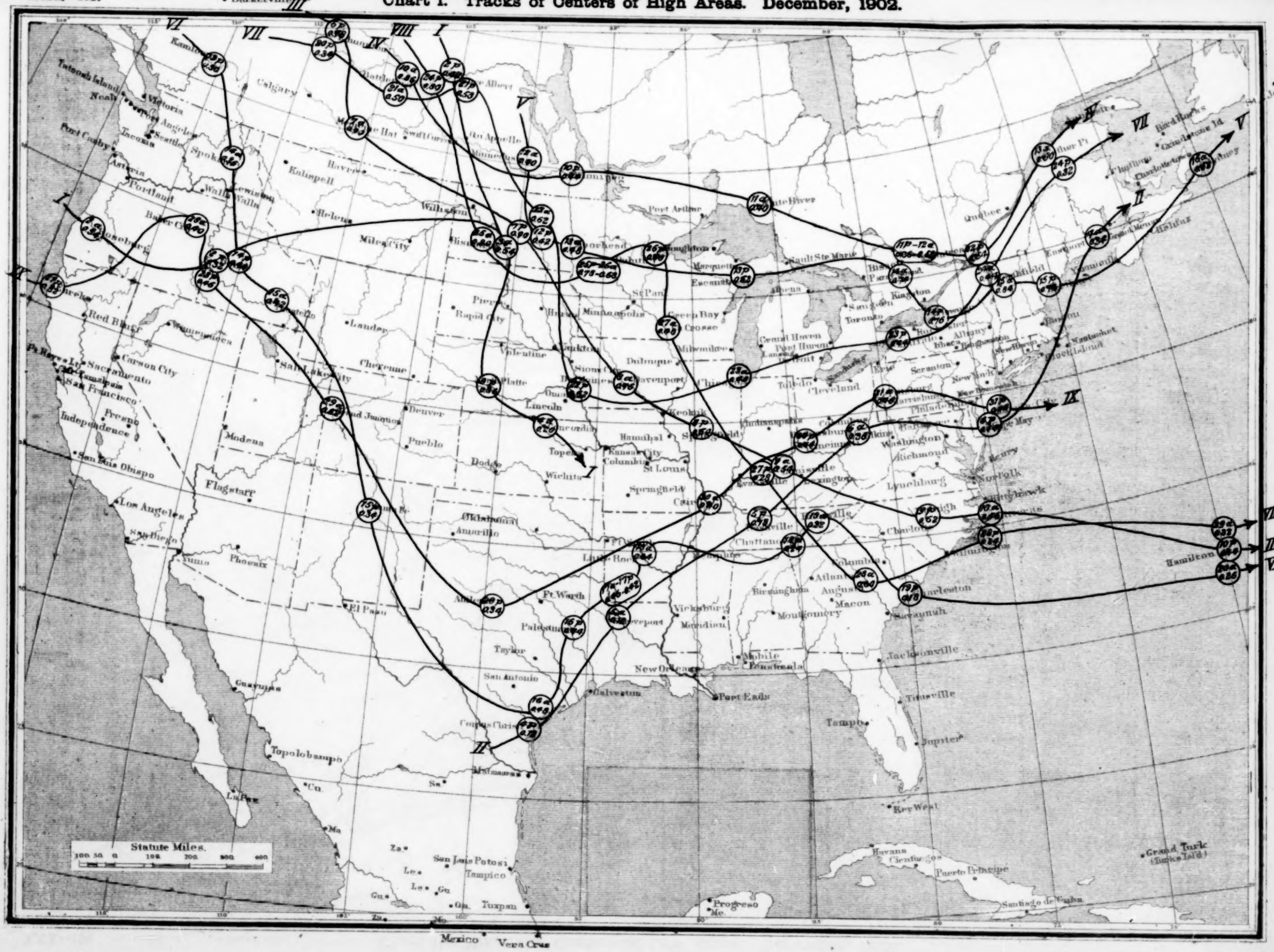
December, 1902.

Stations.	Altitude.	Mean barometer.*	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Chihuahua	4,684	25.22	75.2	26.6	50.0	50	0.47	nc.	.....
Guadalajara (Obs. del. Est.)	5,186	24.93	75.2	43.7	61.9	59	0.21	ese.	.....
Guanajuato	6,640	.....	.....	.....	.....	.....	.....	.....	.....
Leon (Guanajuato)	5,906	.....	.....	.....	.....	.....	.....	.....	.....
Mazatlan	25	29.89	79.9	57.4	72.3	74	0.40	nw.	.....
Merida	50	29.94	94.1	50.0	74.3	80	1.77	ne.	.....
Mexico (Obs. Cent.)	7,472	23.02	71.2	39.2	.....	61	0.02	nw.	sw.
Mexico (E. N. Agric.)	7,442	.....	.....	.....	.....	.....	.....	.....	.....
Monterey (Seminario)	1,626	.....	.....	.....	.....	.....	.....	.....	.....
Morelia (Seminario)	6,401	23.91	72.0	37.0	54.5	63	.....	s.	s.
Puebla (Col. Cath.)	7,108	23.36	75.2	40.1	57.6	68	0.05	ese.	.....
Puebla (Col. d Est.)	7,118	23.33	74.5	35.2	53.8	68	0.18	e.	.....
Queretario	6,070	.....	.....	.....	.....	.....	.....	.....	.....
Toluca	8,812	21.92	66.2	30.6	48.4	65	0.52	w.	.....
Zacatecas	8,015	22.47	70.2	28.4	51.6	61	0.44	w.	.....
Zapotlan	5,078	25.06	79.7	45.3	61.2	64	0.08	e.	.....

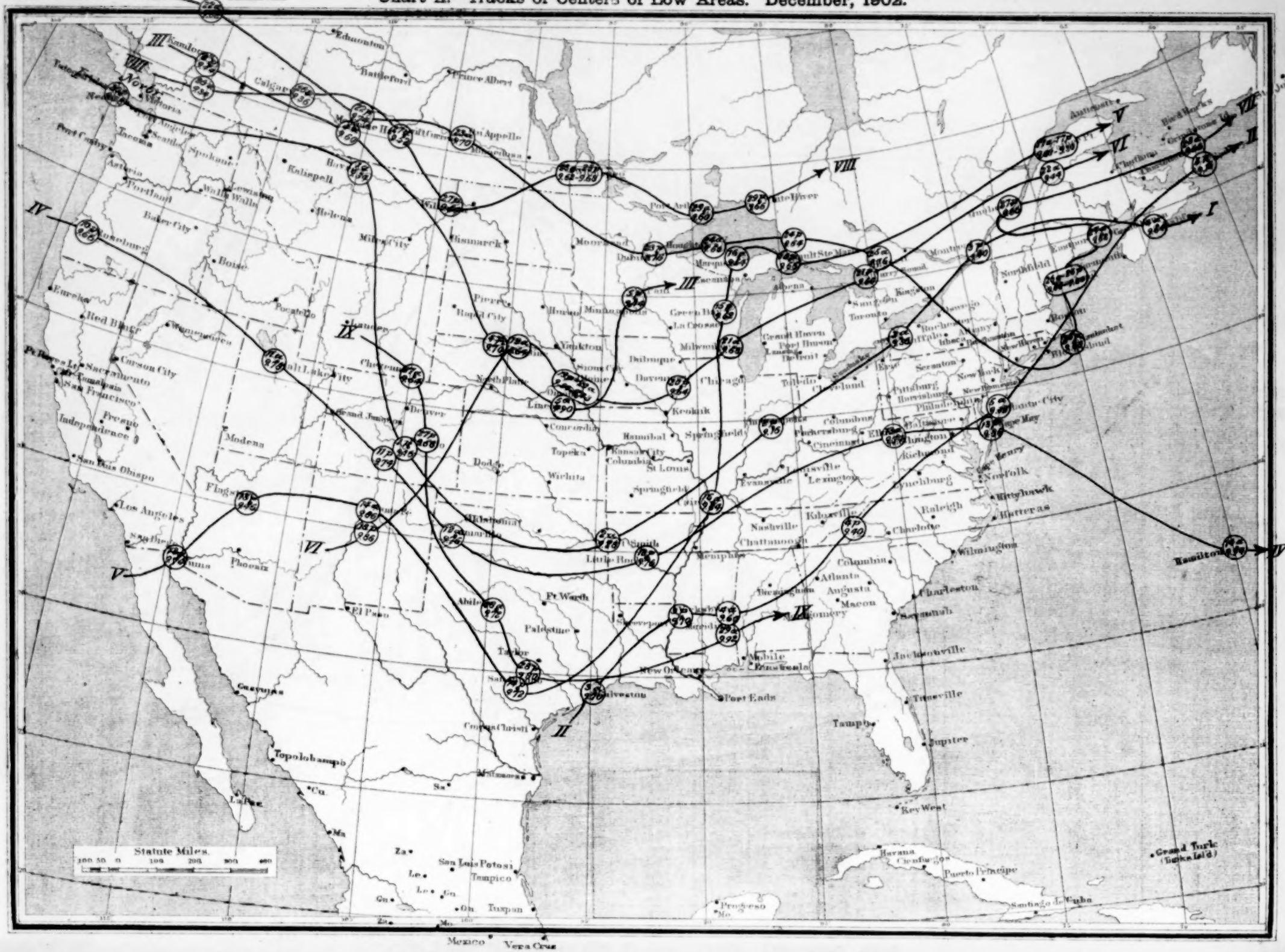
*The monthly barometric means are reduced to the international standard of gravity.

Chart I. Tracks of Centers of Barkerville XXX—101.

Chart I. Tracks of Centers of High Areas. December, 1902.


Statute Miles.
100 50 0 100 200 300 400
Barkerville
Calgary
Victoria
Seattle
Spokane
Portland
Helena
Miles City
Minneapolis
St Paul
Duluth
Port Arthur
Sault Ste Marie
Marquette
Escanaba
Green Bay
Milwaukee
Chicago
Toronto
Ottawa
Quebec
Buffalo
Albany
Boston
Cleveland
Toledo
Scranton
New York
Philadelphia
Atlantic City
Washington
Richmond
Norfolk
Lynchburg
Charleston
Columbia
Atlanta
Augusta
Macon
Savannah
Jacksonville
Tampa
Jupiter
Key West
Tallahassee
Montgomery
Mobile
New Orleans
Vicksburg
Meridian
Birmingham
Chattanooga
Knoxville
Nashville
Louisville
Cincinnati
Columbus
Pittsburg
Erie
Detroit
Port Huron
Grand Haven
Port Huron
Bird Rock
Grindstone Id
Father Pt
Charlottetown
Pictou
Halifax
St Johns
Grand Turk
(Turks Isl'd)
Havana
Cienfuegos
Puerto Principe
Santiago de Cuba
Progreso
Tuxpan
Tampico
San Luis Potosi
Vera Cruz
Mexico
Galveston
Port Eads
Corpus Christi
San Antonio
Ft Worth
Dallas
Austin
Palestine
Taylor
El Paso
Chihuahua
Durango
Topolobampo
La Paz
Mazatlan
Guaymas
Yuma
Phoenix
Tucson
San Diego
Los Angeles
San Luis Obispo
San Francisco
Sacramento
Carson City
Red Bluff
Portland
Tacoma
Seattle
Spokane
Walla Walla
Lewiston
Kalispell
Havre
Swift Current
Moose Jaw
Battleford
Prince Albert
Qu'Appelle
Winnipeg
Port Arthur
Duluth
Minneapolis
St Paul
Rapid City
Huron
Aberdeen
Bismarck
Williston
Dickinson
Miles City
Billings
Helena
Butte
Missoula
Kalispell
Havre
Medicine Hat
Calgary
Edmonton
Prince Albert
Battleford
Swift Current
Moose Jaw
Qu'Appelle
Winnipeg
Port Arthur
Sault Ste Marie
Marquette
Escanaba
Green Bay
Milwaukee
Chicago
Toronto
Ottawa
Quebec
Buffalo
Albany
Boston
Cleveland
Toledo
Scranton
New York
Philadelphia
Atlantic City
Washington
Richmond
Norfolk
Lynchburg
Charleston
Columbia
Atlanta
Augusta
Macon
Savannah
Jacksonville
Tampa
Jupiter
Key West
Tallahassee
Montgomery
Mobile
New Orleans
Vicksburg
Meridian
Birmingham
Chattanooga
Knoxville
Nashville
Louisville
Cincinnati
Columbus
Pittsburg
Erie
Detroit
Port Huron
Grand Haven

XXX—102. Chart II. Tracks of Centers of Low Areas. December, 1902.



XXX—103. Chart III. Total Precipitation. December, 1902.

Chart III. Total Precipitation. December, 1902.

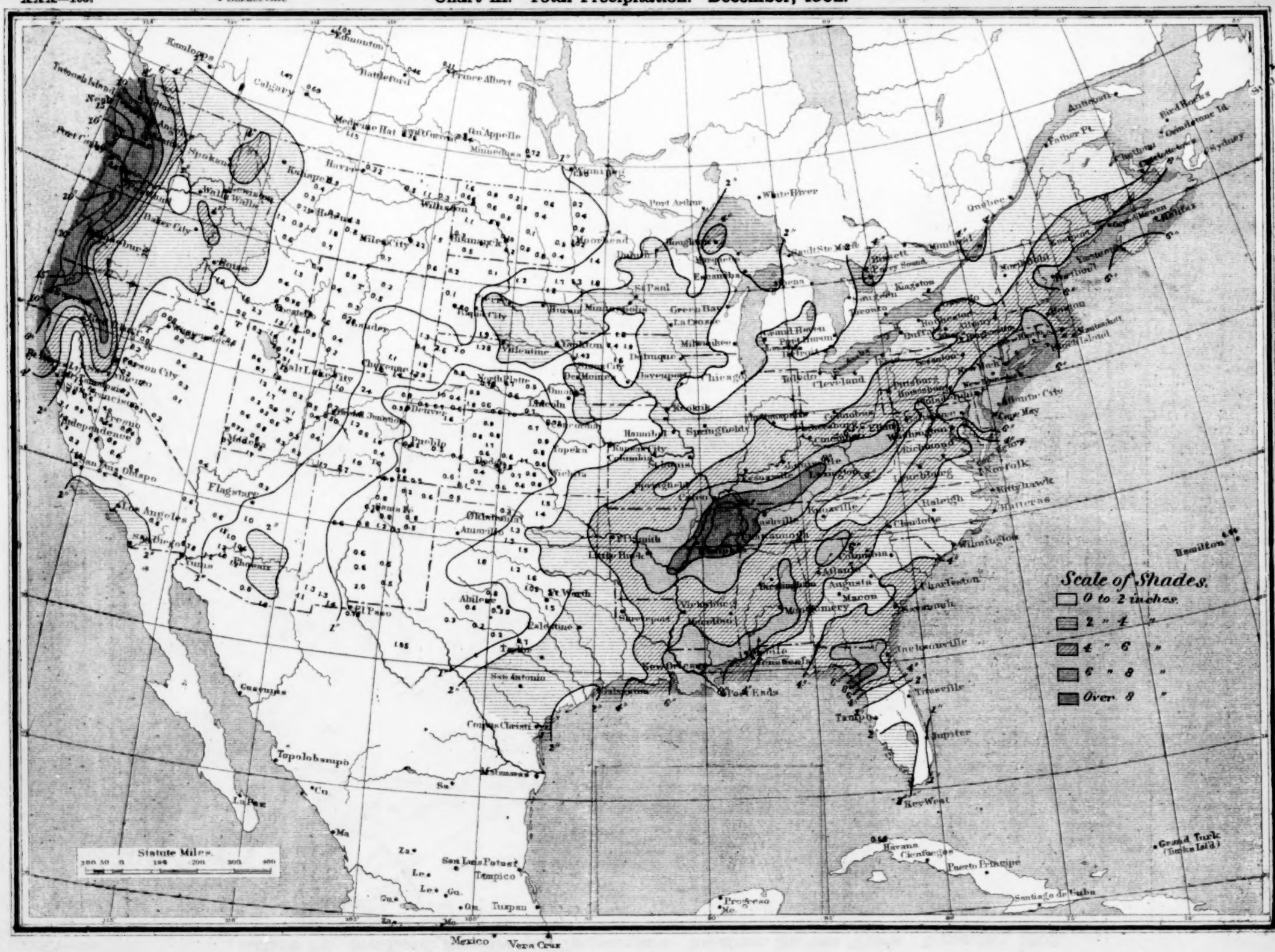
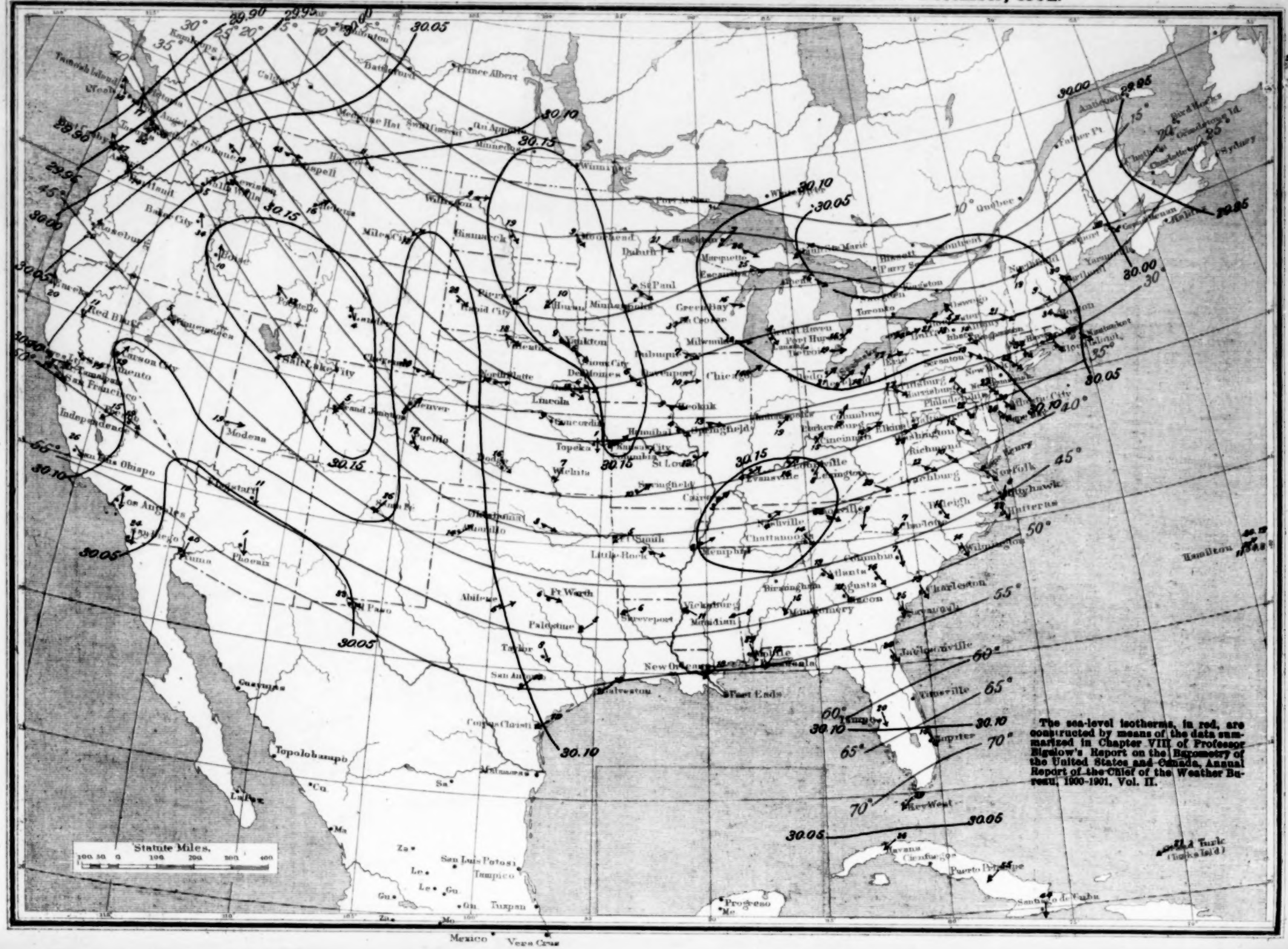


Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. December, 1902.



The sea-level isotherms, in red, are constructed by means of the data summarized in Chapter VIII of Professor Bigelow's Report on the Barometry of the United States and Canada, Annual Report of the Chief of the Weather Bureau, 1900-1901, Vol. II.

 Chart V. Hydrographs for Seven Principal Rivers of the United States. December, 1902.

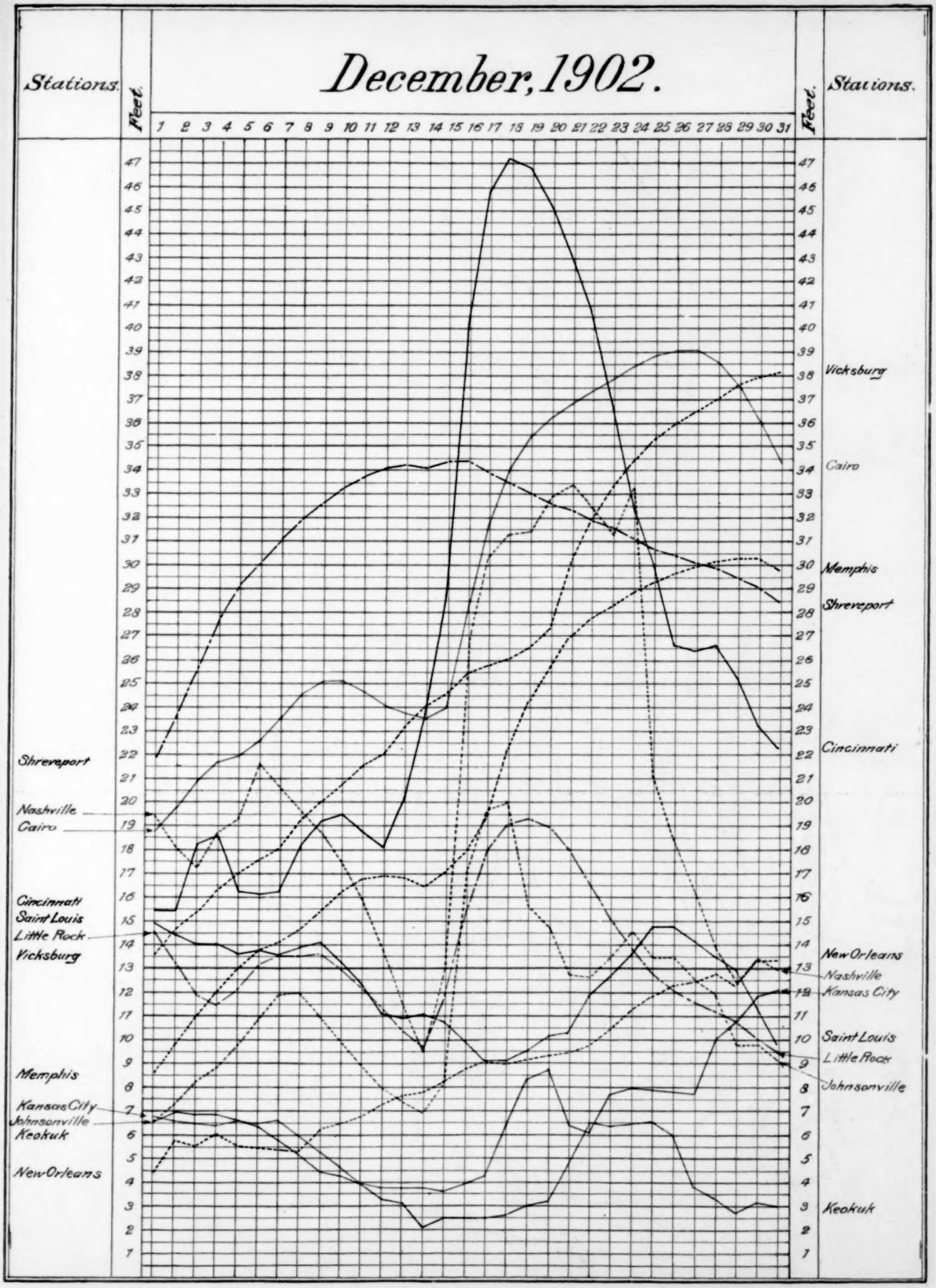


Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. December, 1902.

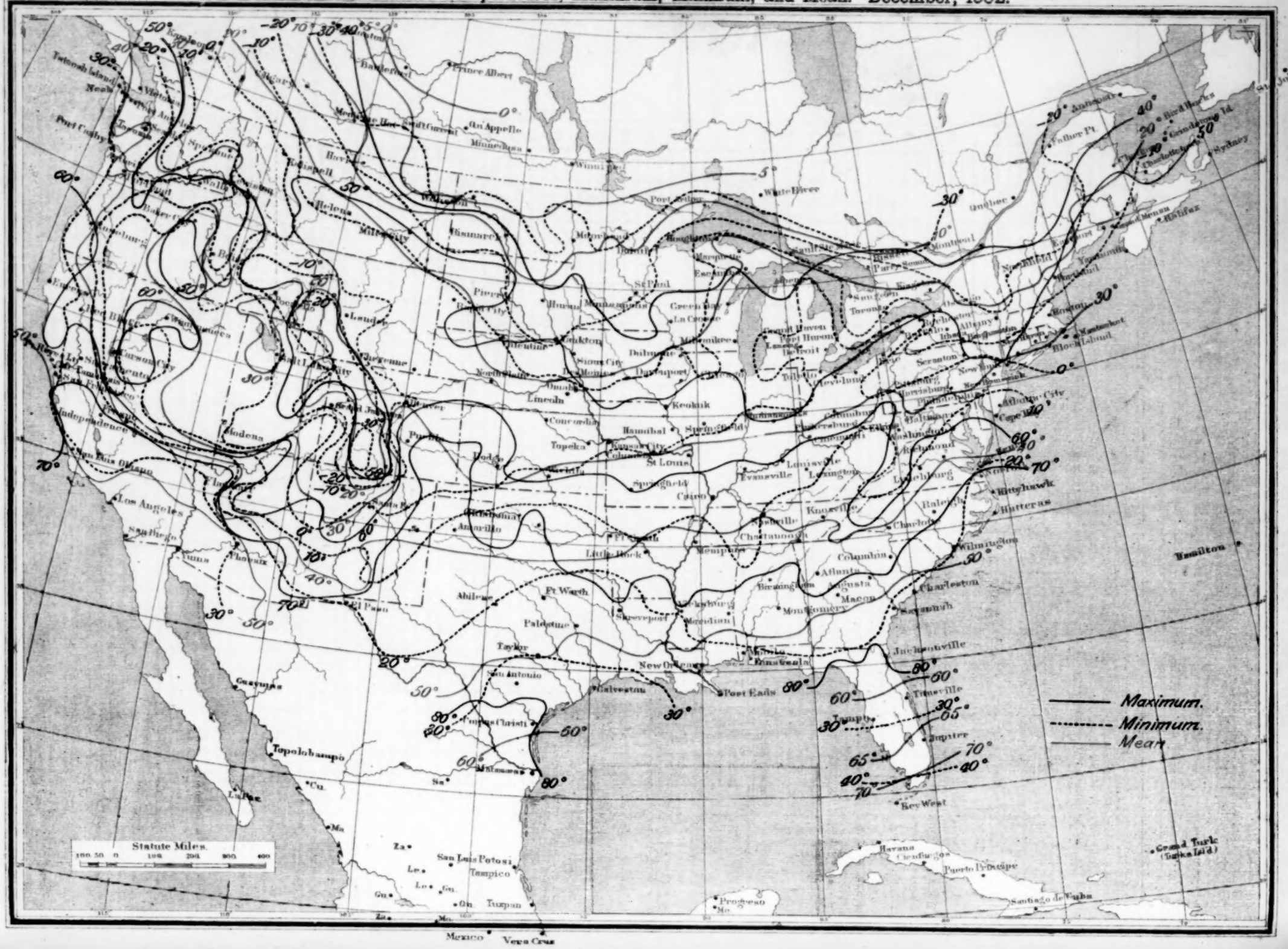


Chart VII. Percentage of Sunshine. December, 1902.

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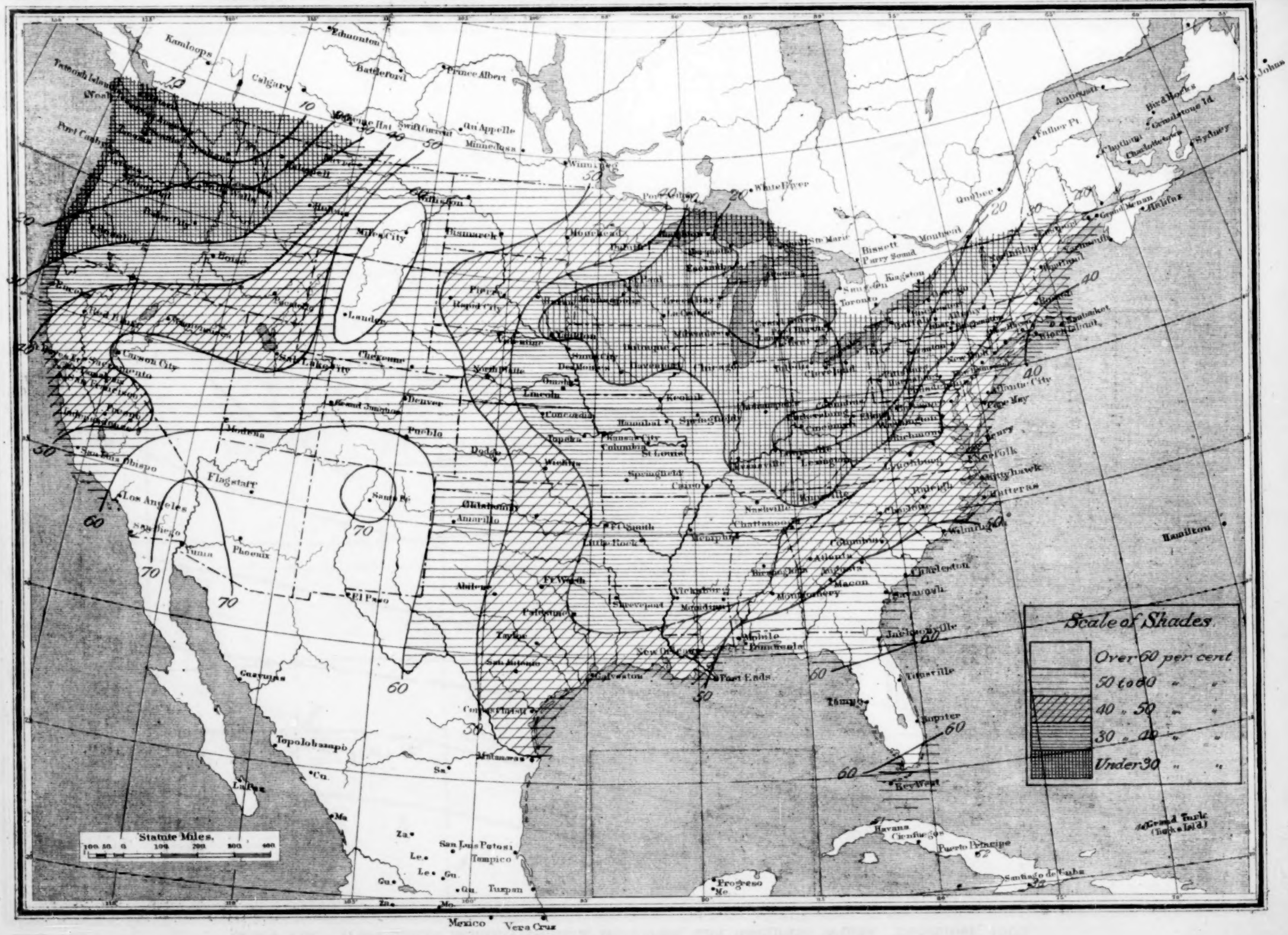
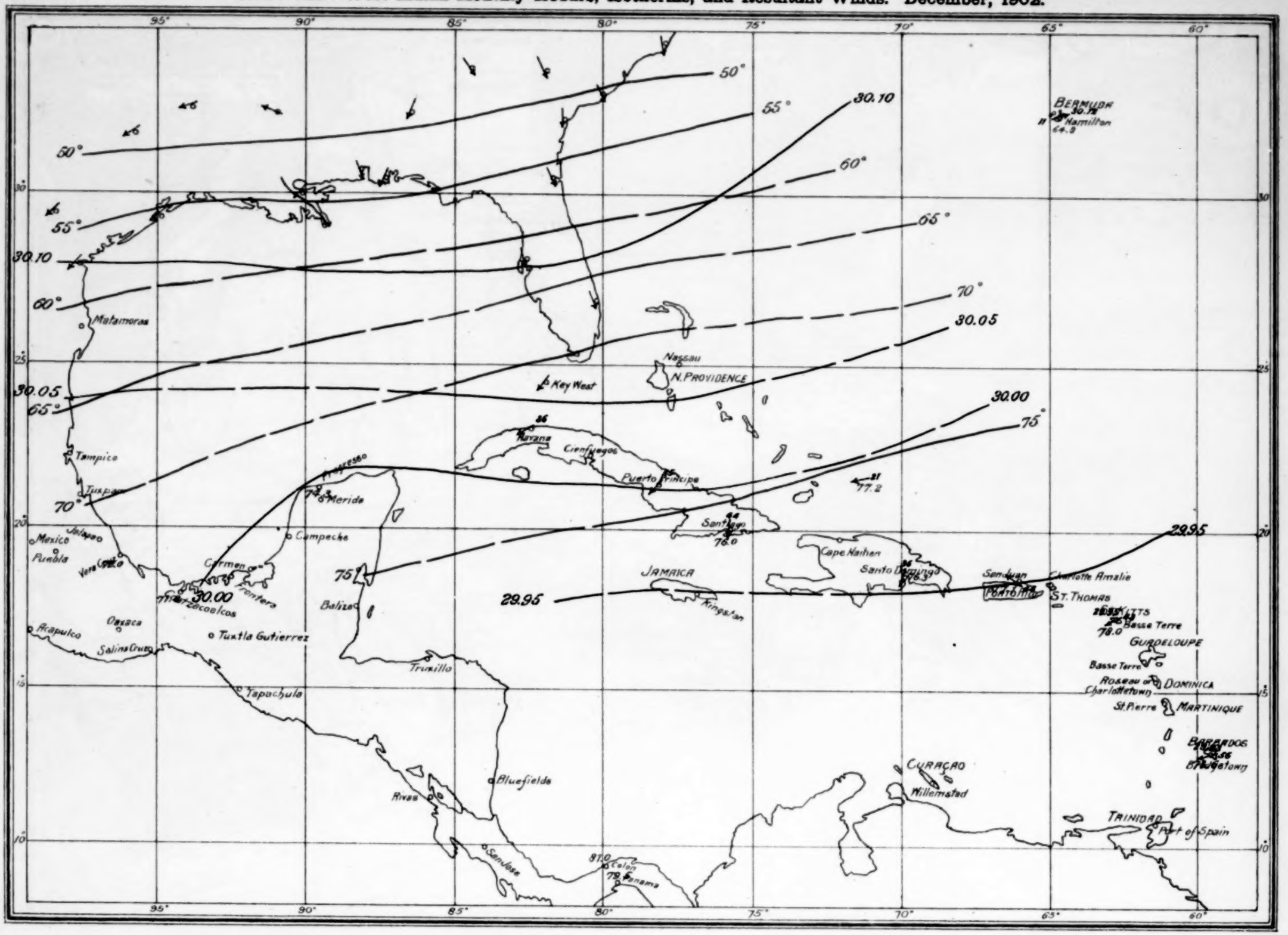
Chart VII. Percentage of Sunshine. December, 1902.



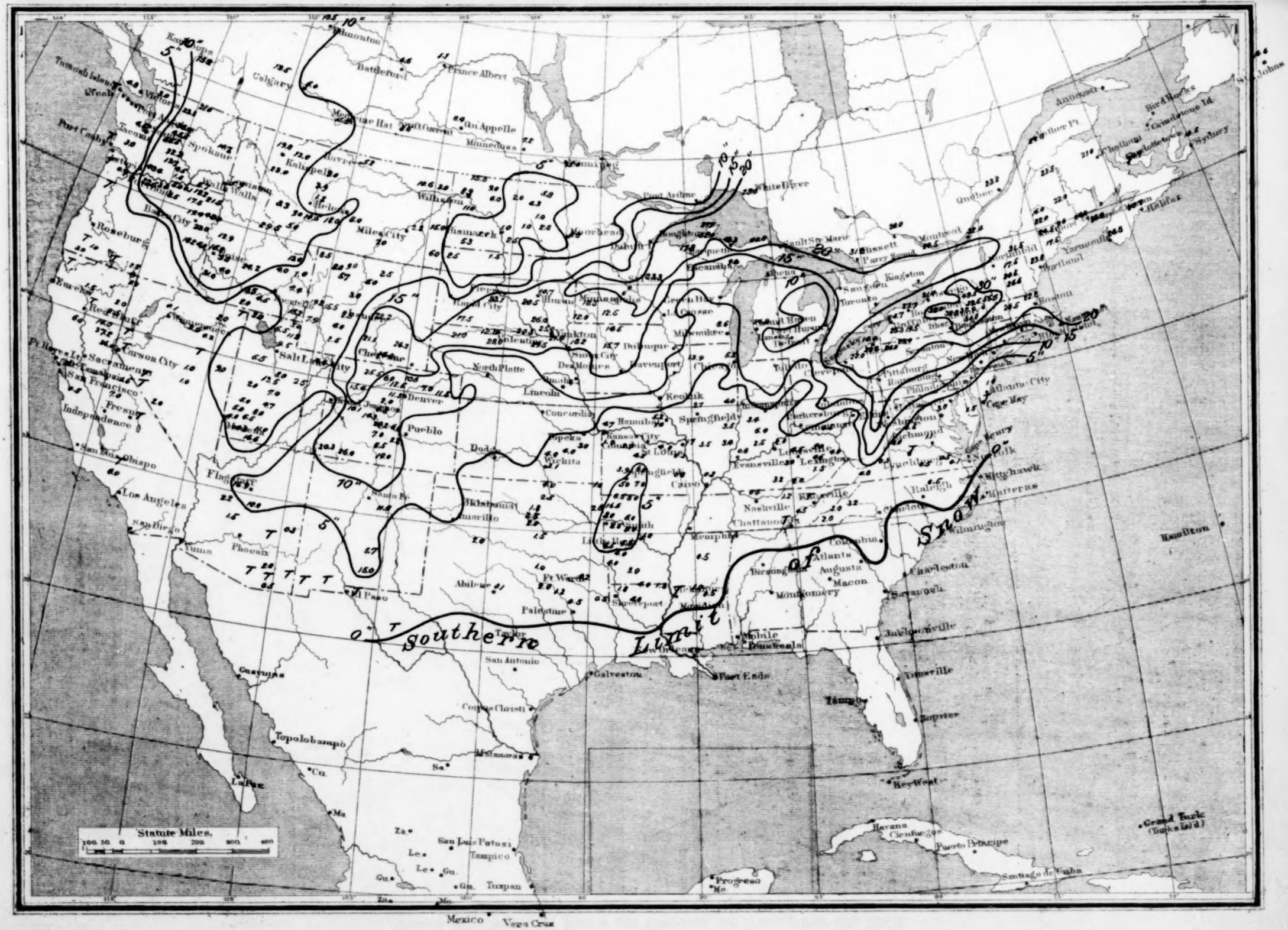
XXX–108. **Chart VIII. West Indian Monthly Isobars, Isotherms, and Resultant Winds. December, 1902.**



XXX–109. Barkerville **Chart IX. Total Snowfall for December, 1902.**

Bakerville

Chart IX. Total Snowfall for December, 1902.



• Barkerville

Chart X. Depth of Snow on Ground on December 31, 1902.